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ABSTRACT

This document is one in a series of instructional materials on population education developed for the Baltimore public schools. The unit, designed for elementary grades 5 and 6, focuses on demography and human factors and consequences. The first part of the resource unit presents basic information, methodology, and understandings of demography and population growth. Extensive use is made of charts and graphs and mathematics to present the problems surrounding population trends. The second section introduces the human element of population growth and possible consequences of overpopulation. The focus is on the implications of population growth for the society, individual, and earth which are seen as interrelated concepts. Each episode in the unit contains the topic, objectives, materials needed, discussion, and activities. This unit may be taught as a whole, or specific topics within the unit may be taught separately. (Author/JR)

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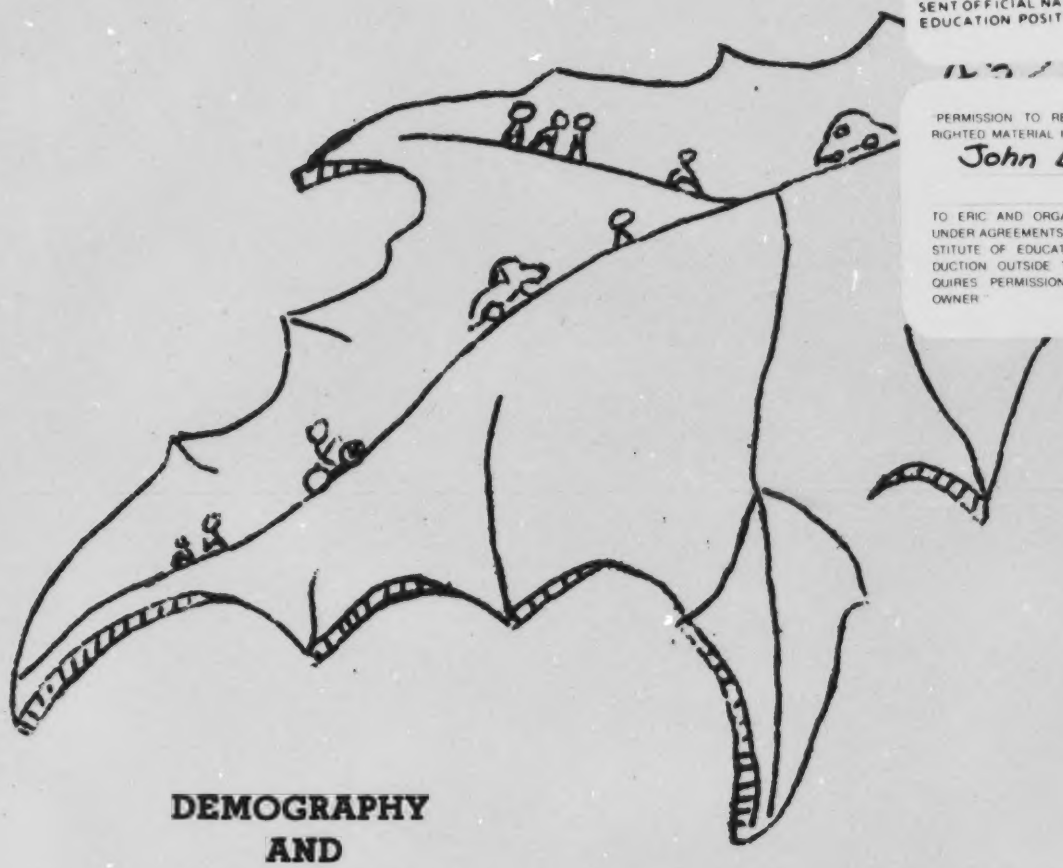

DEMOGRAPHY AND ENVIRONMENT EARTH

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WHY POPULATION EDUCATION?

INTRODUCTION TO UNIT
For The Teacher

"Be fruitful and multiply and replenish the earth," says the Old Testament, and this injunction echoes through the books of all religions. From Man's earliest recorded history up to the time of Christ, through the Middle Ages and until the 18th century, women have borne large families attempting to "replenish the earth". It was not an easy assignment. Deaths caused by famine, disease (particularly in childhood), and wars were so common that, for many thousands of years, the balance between births and deaths was nearly stable. Population growth was very slow and very unsteady.

We all know that this is no longer true. We have heard that the population is "exploding", that food shortages threaten many nations, that Man is using the resources of his planet too greedily. Students, like teachers, have some notion of population pressures from TV and other media as well as from their own urban surroundings. Very few, however, have such exposure to the facts.

It is our belief that teaching the facts of population and their implications for the next generation of Americans should not be postponed until college or graduate school. All high school students can be "demographically literate". All can be aware of America's position among developed and underdeveloped nations. They can learn about population change in their own city and how it affects their lives. They can examine the options open to them in choosing their own life-styles and understand that their future decisions about child-bearing will have "demographic consequences" as well as personal consequences.

This unit is an experiment in Population Education. Its success will depend largely on the teacher's good sense, flexibility and selectivity. Not all activities will be appropriate for all classes. She is urged to plan ahead and choose, to add and delete. Most of all, her success will depend on her sensitivity to individuals. The facts of population can be twisted into propaganda for a particular viewpoint. We hope the teacher will be objective where the facts are concerned and subjective where her students are concerned. No child should feel guilty about being number 9 or 10. No child should be criticized if he wants to raise a large family. But he should know the facts. Hopefully, this unit will make him aware of some of them, and better equip him to make decisions as a potential parent, a voter, and a citizen of planet Earth.

OVERVIEW

Population - Unit Topic

I. Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

II. Population - Investigating Human Factors and Consequences

A. Population and Society

B. Population and the Individual

C. Population and Environment Earth

* *

USING THE UNIT

The population unit may be used in two ways. First, the unit may be taught as a self-contained, multi-disciplinary whole which explores various dimensions of the population question. Topic I, Demography, provides the basic information, methodology, and understandings of population and population growth. Topic II, Human Factors and Consequences, explores the implications of population growth for the society, individual, and Earth, which are seen as interrelated concepts.

On the other hand, the specific topics of the unit may be taught separately by infusion into existing subject areas. Topic I, Demography, may be taught separately as a mathematics unit on graphs. Topic II, Population and Environment Earth, may be taught separately as a science unit.

TEACHING APPROACH

The teaching approach of this unit is based on four considerations:

1. that population problems are complex problems of synergistic interrelationships between population, the society, the individual and Environment Earth.

2. that teaching and learning should actively involve students (active relevance);
3. that teaching and learning should relate to personal experiences of the students (experiential relevance);
4. that teaching and learning should involve insights as to relationships between concepts (insight relevance - which is similar to experiential, abstract, conceptual experiences rather than concrete experiences).

While specific concepts and vocabulary are outlined for this unit, it is important that these be viewed only as basics. By far the most important goal for this unit is the establishment of a dialogue, an examination of the relationships between concepts and experiences, between concepts and concepts, between concepts and values. This will necessitate a willingness on the teacher's part to follow with the students any avenues of exploration which the students find meaningful in relation to population. As much as possible, this unit works through a process of problem identification, hypothesis, and evaluation, with an emphasis on observing, collecting, organizing, and presenting first-hand data.

The way in which a specific teacher uses the unit will depend on his or her needs and priorities. In summary then, the teacher may teach the unit as a whole, or the teacher may pull a specific topic from the unit and teach it as part of the social studies, science or math unit.

The following criteria should be met:

1. Materials that accurately present demographic information and relationships between population trends and various social and environmental consequences.

2. Materials that require the student to analyze for himself the relevant issues and information in order to draw conclusions regarding the central questions which are raised.

3. Materials which excite and motivate, as well as inform, the student.

In General

I Meaning of Population Process

II Population Characteristics

III The Cause of Population Changes

IV Consequences of Process, Characteristics and Changes

V The Impact on the Individual

For Geography

1. Global Population Dynamics

2. Area Population Patterns

3. Population Patterns and Resource Development

For Geography Primary

- Studying movements of people (into and from houses and schools) students may understand how a population changes and grows;

- Then, by studying a shopping area situation, they may see some problems of population movement and growth.

Topic I: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Concept:

A. Demography, the study of population, provides information for understanding population growth, composition, trends and changes.

B. Recently, population has begun to grow at a rapid rate, resulting in what has been called the Population Explosion.

C. World population grows when the birth rate is higher than the death rate (i.e., the number of births occurring during a specific period of time is greater than the number of deaths occurring during the same period of time). The population of a country, city, etc. grows when the birth rate and rate of in-migration is higher than the death rate and rate of out-migration.

D. The earth can support only a certain number of people. At some point, we can assume, there will be zero population growth, that is, population growth cannot continue indefinitely.

E. Presently, population is becoming more concentrated into urban areas - the population implosion.

F. The age structure of a population is an important index of population growth and of the population's ability to meet its resource and economic needs.

G. Personal decisions have demographic consequences (i.e., effects on population growth, density, distribution, and composition).

OUTLINE OF EPISODES

CONCEPTS AND VOCABULARY

Episodes	Concepts	Vocabulary (Generalizations)
Episode I	B	population population explosion technology graph
Episode II	C, B, A	demography growth growth rate birth rate death rate doubling time
Episode III	C	school population in-migration out-migration census
Episode IV	D	carrying capacity optimum population values continents or regions estimate
Episode V	E	urban rural suburban migration distribution
Episode VI	E	density square mile area (size)
Episode VII	F	age structure age group census male, female productive population dependent population
Episode VIII	G	future population growth 2, 3, 4 - child families family size relationship

* You might wish to make cards for the vocabulary (generalizations) for each episode.

GLOSSARY

Age Structure ..... the percentage of the population in each age category

Birth Rate ..... the number of births per year per 1,000 population (mid-year)

Carrying Capacity ..... the maximum sustainable size of the resident population in a given ecosystem

Census ..... an official enumeration of the total population at a given point in time or during a specific period of time with details as to age, sex, occupation, etc.

Composition ..... make-up, structure, constitution of population as to age, race, economic class, etc.

Death Rate..... the number of deaths per year per 1,000 population (mid-year)

Demography ..... the science of vital and social statistics, as of the births, deaths, diseases, marriages, etc. of a population; the study of population, its composition, age structure, and trends

Density ..... population size in relation to a unit of space; number of people per unit of space

Distribution ..... geographical placement, location, arrangement of population

Environment ..... the aggregate of all the external conditions and influences affecting life development and ultimately the survival of an organism

Finite ..... having bounds or limits

Growth ..... increase in absolute number

Natural Increase ..... the difference between the annual birth rate and death rate times 100

Population Growth Rate ... difference between the birth rate plus the rate of in-migration, and the death rate plus the rate of out-migration, (BR + R of In-Mig.) - (DR + R of Out-Mig.)

Implosion ..... concentration of population into urban areas

In-Migration ..... people moving or changing residence

Metropolitan Area ..... a city and its surrounding suburban areas

Optimum ..... the best or most favorable

Glossary (Con't)

Population.....	the total number of persons (or units of something, for example, plants) inhabiting a specific area
Population Doubling Time..	the number of years it takes for a population to double
Rural.....	the country, as opposed to the city; towns and farms
Suburban.....	any district or area lying immediately outside of the city
Urban.....	pertaining to a city

EPISODE ONE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Setting the Scene - Population Growth

Objective: Pupils should be able to identify at least two causes of population growth.

Discussion: This episode is intended to introduce population growth throughout history and to explore some causes of rapid population growth.

Human population grew very slowly during man's first two million years. As man progressed from hunter and gatherer to herder and farmer (perhaps about 8000 B.C.), population began to grow more rapidly, although still very slowly. This growth was probably the result of man having a larger and more stable food supply. During this period (8000 B.C. to the modern period), man's technology began to develop more rapidly also. By 1650 A.D. there were approximately 500 million people on earth (see graphs for Episode I). By 1850 the population reached about one billion. In the two hundred year period between 1650-1850 the world population had doubled. It doubled again in 80 years, reaching two billion by about 1930. The world population is expected to be about four billion by 1975, having taken only 45 years to double this time. At present growth rates, population will again double by about 2010, having taken only 35 years to go from about 3.5 billion world population in 1972 to about 7 billion world population in 2010.

It is this rapid population growth which is called the population explosion. Much of this rapid population growth can be correlated with the industrial revolution. Technology has had much impact on population growth by bringing about a decrease in the death rate through increasing the food supply and improving health and sanitation measures.

Episodes may take several days. Feel free to add to, delete from, or change these episodes as the class and personal needs suggest.

Episode One

Getting Ready: Assemble an interest center with population throughout history as the focus. Let the center sit around for a couple of days so that students have a chance to look, question, make mental connections among the pictures, and add to the collection if they so desire. Your interest center might look something like this:

Pictures of Primitive Man	Pictures of Changes	Pictures of Modern Man

The idea of this center is to contrast early man and modern man - to provide a visual picture of population growth and to suggest some causes.

Your contribution to the center might include:

* Pictures of man from early man to urban man
* Pictures of primitive villages through modern megalopolis
* Pictures from around the globe - from sparsely populated to densely populated areas
* Pictures suggesting birth and death - juxtaposed
* Pictures of tools from flint to computers, from hoes to modern farm equipment
* Pictures of man the hunter to man the farmer
* Pictures of medicine - primitive to modern
* Graphs of population growth
* Pictures crowded with people to pictures without people

Many of the materials for the interest center are included. It is suggested that you supplement these materials with pictures of your own. National Geographic is a good source.

Beginning: Part I - The What (Describing)

Have the class describe exactly what they see in the interest center. Record on board or chart. (Stick simply to description. Have class avoid interpretation at this point.)

Part II - The Why (Hypothesizing)

Have class begin to interpret purpose of interest center, hypothesize as to the connections between the items in the interest center.

Have class hypothesize as to whether population is growing, declining or stable.

Have class give supporting evidence for hypothesis. As the class arrives at idea of population growth, have them give factors from interest center that would contribute to growth. Much of this evidence is suggested by the interest center (evidences of population growth and reasons - farming, technological advance, advances in health and medicine).

Part III - Checking It Out (Testing the Hypothesis)

Overhead projector - graph of population growth through the ages

graph of the population growth 1400-2000

1. Check graphs as to whether growth has occurred. Have pupils describe, interpret graph.

2. Check graphs to see if population growth is correlated with advances in farming, technology, and medicine. (Note slow increase from 8000 B.C. correlated with farming. Note rapid growth from about 1850, correlated with technology, modern farming, modern medicine).

Part IV - Summing It Up

Have pupils verbalize tentative concepts as to population growth and some causes.
Record on chart.

Part V - Now What? (More Testing)

Have pupils (groups) graph: U.S. growth
Maryland growth
Baltimore area growth

Discuss (or have groups discuss) - Do these graphs support the class's general hypothesis about population growth?

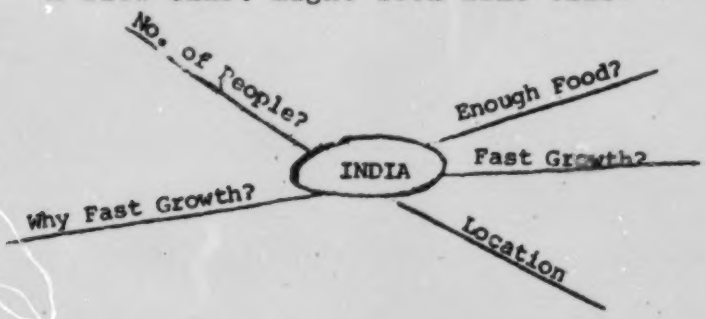
Part VI - Film - See one of the population films on the Instructional Materials Center list in this packet.

Does this film support the class's basic hypothesis?

What new did the film have to say? (Each pupil or whole class might make a comparison chart showing how film supports hypothesis and/or adds new ideas. Categories might be supporting evidence and new ideas.)

Part VII - Research (This may be done at any point.)

If there are topics pupils wish to pursue from film or any other source, pupils may plan their own research. One way to do this is through the use of flow charts. A flow chart might look like this:

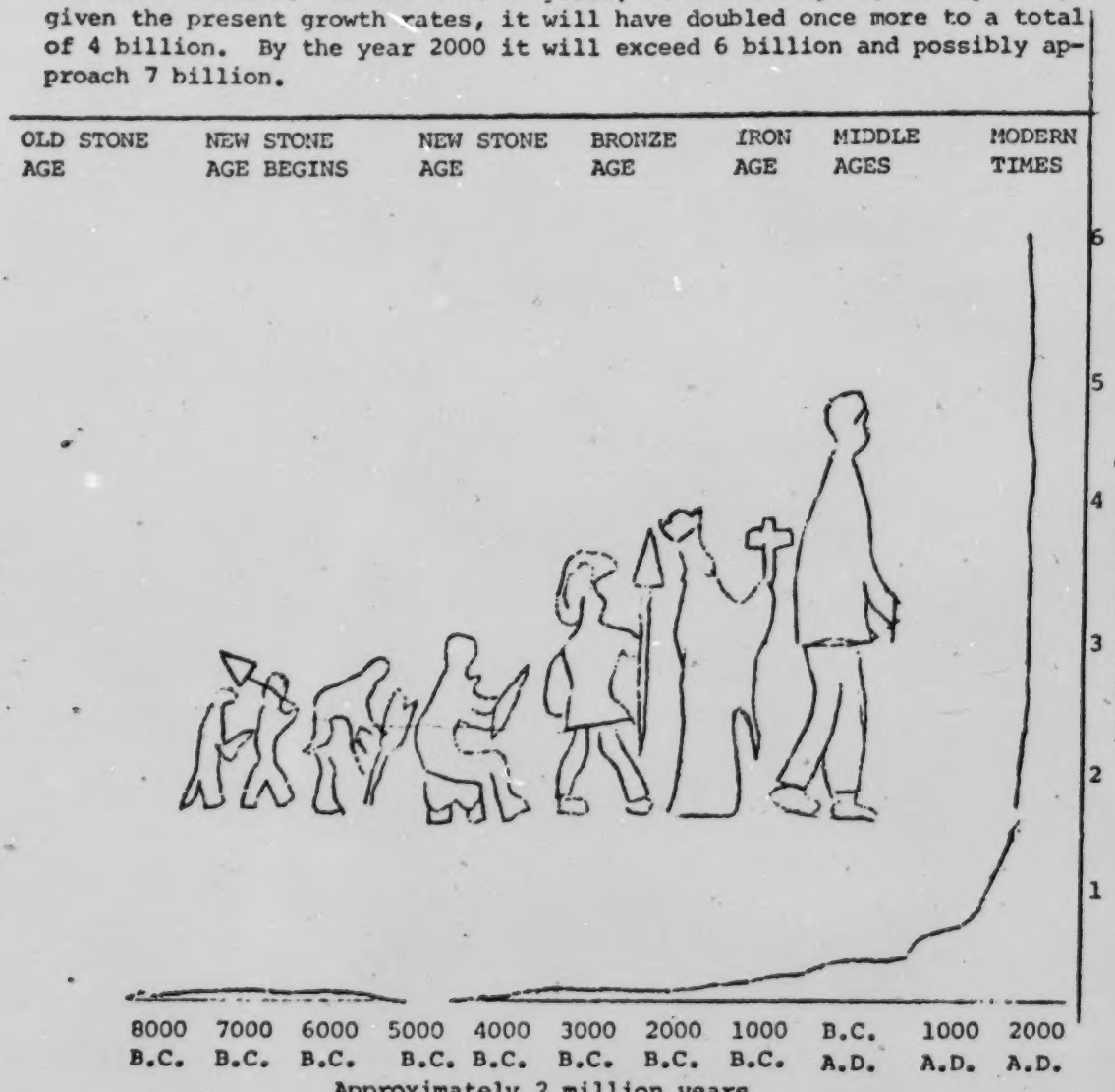


The topic to be studied is put in the center. On rays coming out of the center, the pupil lists questions he wishes to answer or information he wishes to find. The flow chart thereby plans the pupil's research. Secondly, both the student and the teacher can evaluate his research in terms of whether he has covered all the items on the flow chart.

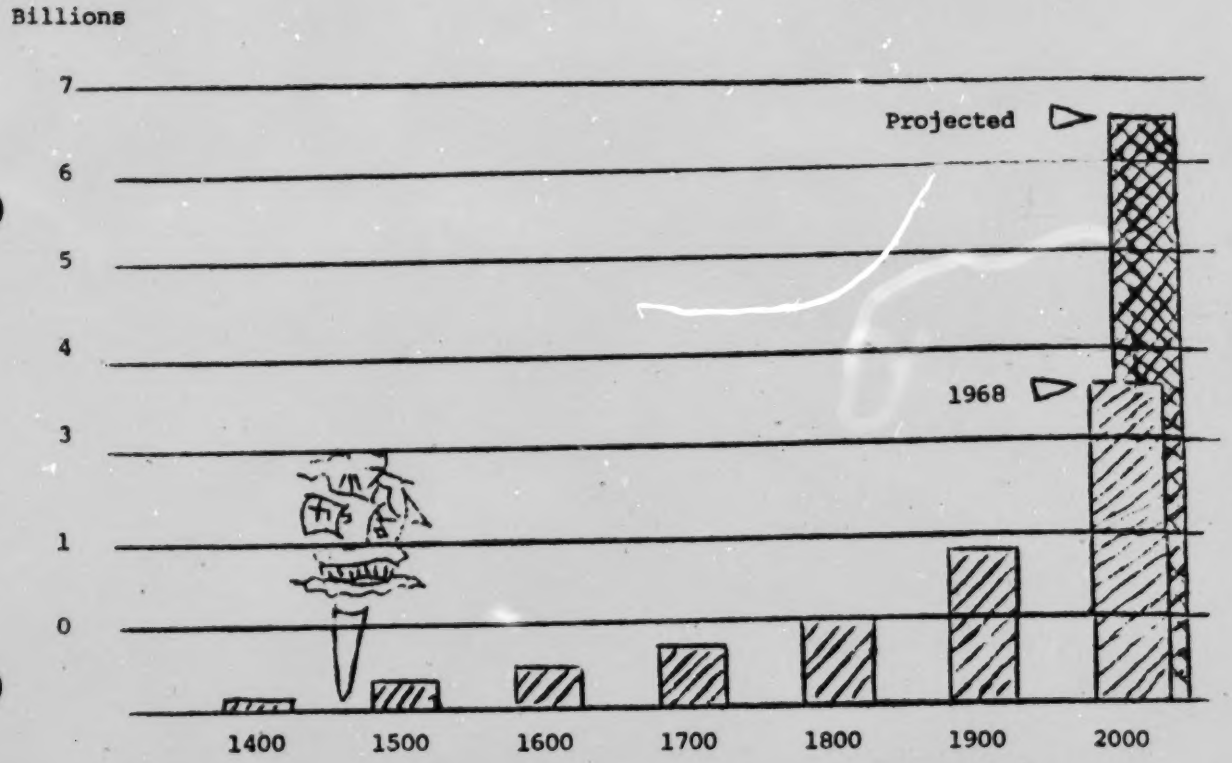
POPULATION GROWTH THROUGH THE AGES

During the hundreds of thousands of years of the Old Stone Age when man was a hunter and a food gatherer, world population probably never exceeded 10 million. Then, sometime between 8000 B.C. and 6000 B.C., man learned to grow his own food, and to create settlements and eventually cities. In the next 8000 to 10,000 years, his population increased fifty-fold, reaching an estimated 500 million by 1650 A.D.

In 200 years, from 1650 to 1850, world population doubled and reached its first billion. In the next 80 years, it doubled again, and by 1975, given the present growth rates, it will have doubled once more to a total of 4 billion. By the year 2000 it will exceed 6 billion and possibly approach 7 billion.



WORLD POPULATION, 1400-2000 A.D.

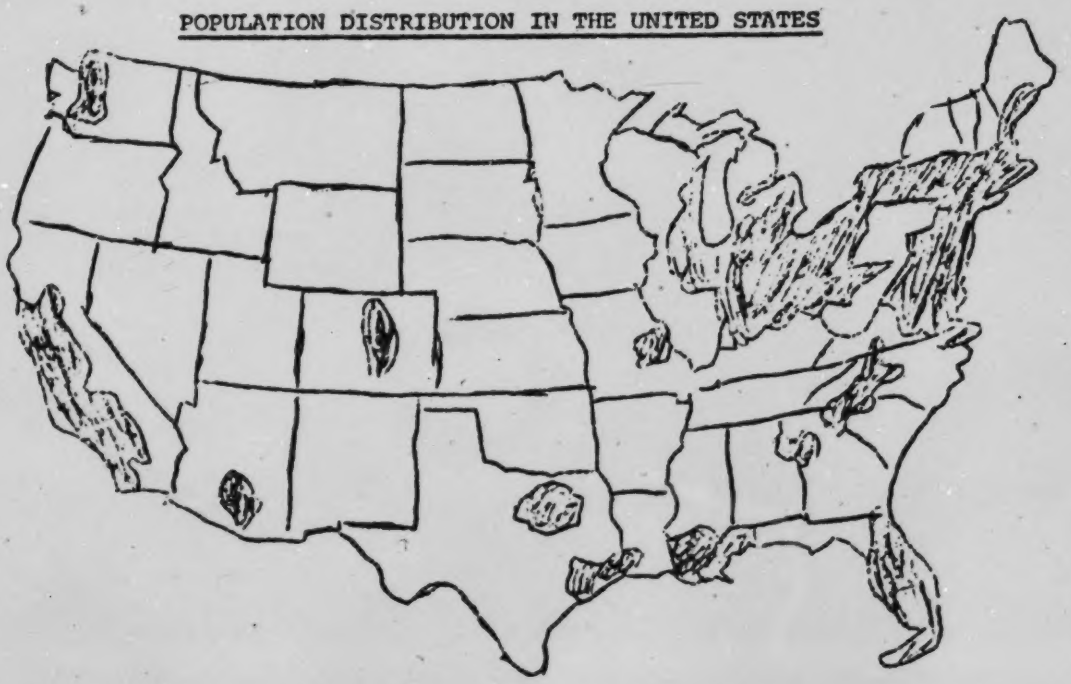


BALTIMORE CITY POPULATION
(1790-1970)

YEAR	POPULATION (rounded off to nearest thousand)
1790	14,000
1820	63,000
1850	169,000
1880	332,000
1910	558,000
1940	859,000
1950	950,000
1960	939,000
1970	906,000

Note: Population figures are given in 10 year intervals after 1940.

POPULATION DISTRIBUTION IN THE UNITED STATES



The areas that are shaded in show where most people in the U.S. live and where many more people are moving.

MARYLAND POPULATION

(1900-1970)

YEAR	POPULATION (rounded off to nearest hundred thousand)
1900	1,200,000
1910	1,300,000
1920	1,400,000
1930	1,600,000
1940	1,800,000
1950	2,300,000
1960	3,100,000
1970	3,900,000

Source: United States Census Bureau

UNITED STATES POPULATION
(1790-1970)

YEAR	POPULATION (rounded off to nearest million)
1790	4,000,000
1800	5,000,000
1810	7,000,000
1820	10,000,000
1830	13,000,000
1840	17,000,000
1850	23,000,000
1860	31,000,000
1870	40,000,000
1880	50,000,000
1890	63,000,000
1900	76,000,000
1910	92,000,000
1920	106,000,000
1930	123,000,000
1940	133,000,000
1950	152,000,000
1960	180,000,000
1970	205,000,000
2000 (estimated)	290,000,000

Source: United States Census Bureau

EPISODE TWO

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography: Population Growth

Objective: Pupils should be able to define demography, compute population growth and make predictions about population growth.

Materials:
1. transparency - Births in Center City and Jackson City
2. graph paper
3. chart paper
4. transparency - World Birth and Death Rates

Discussion: This episode is intended to present another way of looking at population growth - from the demographer's point of view.

Demography is the study of population. Demographers compute the growth rate of a particular population by looking at the birth rate and death rate for that population. Growth occur when the number of births per year is greater than the number of deaths per year. Growth rate (i.e., per 1000 people measured by the mid-year population) equals the birth rate (i.e., births per 1000 people) minus the death rate (i.e., deaths per 1000 people). Note that growth and growth rate are different, since growth rate is figured per 1000 people. Example: Dud City has a population of 2,000. Its growth rate is 10 per 1000. In one year, therefore, its growth is 20 people since there are two thousand.

Technically, this growth rate should be called the crude growth rate because it does not include the effect of migration on the population. This will be covered in the next episode.

Part I - Beginning

Show students births in Center City and Jackson City on overhead. (Figures to be filled in for two cities are at end of episode.)

Begin discussion as to which city has the faster growth rate, based only on birth information.

Tell students both cities are growing. Have them predict relationship of births to deaths if a city is growing. (Number of births would be higher than number of deaths.) Give plenty of time for reasoning.

Return to the original question. What other information is needed to figure which city is growing faster? (Number of deaths)

Episode Two

Fill in this information on overhead. Have class arrive at method used to figure growth (that is, births minus deaths). Discuss why birth rates alone are deceiving.

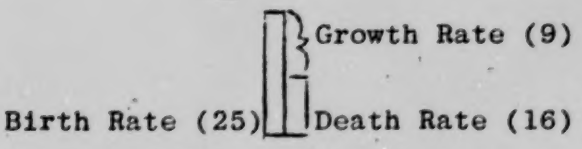
Have class figure growth, birth, death rates. Clarify that rates are figured for groupings of 1000. Fill in on overhead.

Have pupils predict which city will be larger in five years and give reasons. What might change this? (Change in birth or death rate in the cities)

Part II - Birth rate, Death rate, Growth rate (duplicated sheets)

Have pupils figure out missing numbers for Fun City and Far City. Discuss which is growing faster. Review terms.

Have pupils look at graph. Discuss how to read birth, death and growth rates from graph. Tell pupils each set of birth, death and growth rates represented either Center City, Jackson City, Fun City, or Far City. Have pupils lable each city on graph. (Note: Growth rate is found by figuring the difference between birth and death rates, i.e



For math, this episode enables students not only to read graphs but also shows the relationship between charts and graphs, that is, alternate ways to show the same information.

Part III - (The latter part of this episode is quite difficult so do not be afraid to stop if confusion occurs.)

Show students on chart the following figures for Fat City:

	Mid-Year Population	
Fat City	5,000	
Births	-	Birth rate 19 per 1000
Deaths	-	Death rate 10 per 1000
Growth	-	Growth rate __ per 1000

Have pupils fill in the missing blanks. To do this, the class must arrive at the method to figure births and deaths (by figuring out how many groups of 1000 there are in 5000). Pupils may either multiply the birth rate and death rate by 5, or add five times (19 + 19 + 19 + 19 + 19) for example.

Have pupils find the same information for Fat City if its population were 3,000 or 10,000. (Use same birth and death rates.)

Have pupils summarize the effect of different original population sizes when birth and death rates are the same (the greater the population, the greater the growth, i.e., the greater total number of new people added).

Now show pupils the following information on a chart or on the board:

Population
(3,000)

Car City

Births - (75) Birth rate 25 per 1000

Deaths - (30) Death rate 10 per 1000

Growth - (45) Growth rate 15 per 1000

Population
(10,000)

Dodge City

Births - (180) Birth rate 18 per 1000

Deaths - (90) Death rate 9 per 1000

Growth - (90) Growth rate 9 per 1000

* Answers for class to figure out, in parenthesis.

Do not give population figures at first. Have class try to predict which city will have the greatest growth from birth, death, growth rates only. Hopefully, someone will point out that population figures are needed also. Give these figures then and have class now predict which city will have the greatest growth. Spend some time on reasons. Take a vote if you wish.

Have class compute missing figures. Why, despite Car City's much higher growth rate, did Dodge City have more growth? (much larger original population). Evaluate original predictions with class.

At this point it might be useful to have class point out the two factors that need to be known in assessing population growth, population size and growth rate. Write on board or chart. Take time to discuss the effects of each of these on population growth (the greater the population size, the greater the growth; the higher the growth rate, the greater the growth).

*If you wish, you might go back to the overhead projections from Episode I and have class try to explain the population explosion using the terms population size and growth rate (while population size is larger, the growth rate has also become higher and, thus, the population explosion).

Part IV - Growing, Stable, and Declining Population

Show pupils the following three cities (on chart):

Grow City	Paw City
Birth rate 21 per 1000	Birth rate 10 per 1000
Death rate 9 per 1000	Death rate 10 per 1000
Growth rate __ per 1000	Growth rate __per 1000

Scare City

Birth rate 8 per 1000

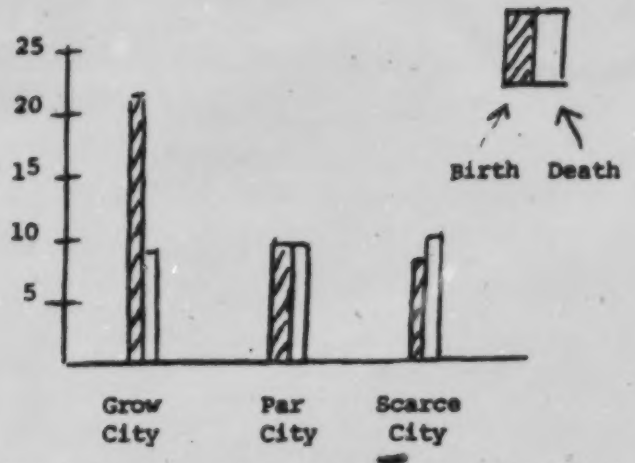
Death rate 11 per 1000

Growth rate__ per 1000

Have pupils find growth rates. What is happening in each city? (Growing? Staying the same? Losing population?) You can show negative growth by a minus sign. Have pupils explain their reasoning.

Then, using graph paper, have pupils graph birth and death rates (i.e., make a bar graph), remembering that growth rate will be the difference between birth rate and death. You may need to discuss what each axis of the graph will represent. Graphs will look something like this: (next page)

Episode Two



The graphs will show visually the differences. Grow City shows birth rate much higher, therefore growth. Par City shows equality, therefore no change. Scarce City shows death rate to be higher, therefore losing population.

Have pupils make generalizations about growing populations, stable populations, and declining populations from this graph.

Part V - The Real World: Growth Rates

Put the world's birth and death rates on chart. Have class find growth rate. (Be sure they understand these figures are real, for the real world.)

Explain doubling time; that is, in 35 years the world population will be double what it is now at the present growth rate of 20 people per 1000 people every year. Explain that, in 1970, world population was 3 1/2 billion. Ask class to figure when the population will double. (in 35 years, 2005 A.D.) Ask what that population will be. (7 billion people)

Have class hypothesize as to the cause of world growth rate; that is, has birth rate gone up or has death rate gone down?

Show overhead graph on world birth and death rates. What has happened? (Generally, death rates have gone down a lot while birth rates have declined only a little. Relate back to first episode as to reasons. You might also note effect of wars as reflected by graph.) Record student observations.

Now give each of four groups data for one of four countries (U.S., India, Sweden, Kenya). Have each group figure growth rate and report findings. Discuss (especially differences in doubling time).

Following through, have students graph data, in the same way as in Part IV. Students might also add other countries to their groups, either as group or individual work. Data can be gotten from the Population Reference Bureau Chart on World Population Growth. Students could also do graphs for continents rather than individual countries. Questions to pursue might be as follows:

1. Which country or continent has the highest birth rate?
2. Which country or continent has the highest death rate?
3. Which country or continent has the lowest birth rate?
4. Which country or continent has the lowest death rate?
5. Which country or continent has the highest growth rate?
6. Which country or continent has the lowest growth rate?

Formulas

1. Crude Birth Rate $CBR = \frac{\text{No. of births per year}}{\text{Mid-year population}} \times 1000$

2. Crude Death Rate $CDR = \frac{\text{No. of deaths per year}}{\text{Mid-year population}} \times 1000$

3. Growth Rate $CBR - CDR = \text{Rate of Natural Increase}$

Beginning: (On chart or board)

Center City	Population 1,000	
Births	20	Birth rate 20 per 1000
Deaths	10	Death rate 10 per 1000
Growth	10	Growth rate 10 per 1000

For Students:

	Population 1,000		
Jackson City			
	Births	25	Birth rate 25 per 1000
	Deaths	16	Death rate 16 per 1000
	Growth	9	Growth rate 9 per 1000

		Doubling Time (Years)
WORLD	Birth rate 33 per 1000	
	Death rate 13 per 1000	
	Growth rate per 1000	35
U.S.	Birth rate 18 per 1000	
	Death rate 9 per 1000	
	Growth rate per 1000	63
INDIA	Birth rate 42 per 1000	
	Death rate 17 per 1000	
	Growth rate per 1000	27
SWEDEN	Birth rate 13 per 1000	
	Death rate 10 per 1000	
	Growth rate per 1000	140
KENYA	Birth rate 48 per 1000	
	Death rate 18 per 1000	
	Growth rate per 1000	23

Episode Two

DOING THE DEMOGRAPHY

(Birth Rate - Death Rate = Growth Rate)

The Situation:

Two small towns, Fun City and Far City, have a problem. The schools in each town are crowded. Mayor Puffer of Fun City thinks the two towns should go together and build a new school. Mayor Graft of Far City thinks the schools are okay the way they are. Neither mayor knows anything about demography so neither one of them knows if the two cities are growing. Mayor Puffer and Mayor Graft finally decide to call in a demographer to find out what is going on. The demographer is you.

The mayors want to know three things: 1) Are the cities growing? 2) Do the two cities need to build a new school soon? 3) In which city should the school be built?

Below is the information from the last census. Your job is to find the missing information and then tell the mayors what should be done.

	Population		
Fun City	1,000		
Births	33	Birth rate	per 1000
Deaths	12	Death rate	per 1000
Growth	__	Growth rate	per 1000

	Population		
Far City	1,000		
Births	12	Birth rate	per 1000
Deaths	9	Death rate	per 1000
Growth	__	Growth rate	per 1000

DOING THE DEMOGRAPHY: POPULATION GROWTH

POPULATION

Center City

Births _____ Birth Rate _____

Deaths _____ Death Rate _____

Growth _____ Growth Rate _____

Total _____

POPULATION

Jackson City

Births _____ Birth Rate ___ Per 1000

Deaths _____ Death Rate ___ Per 1000

Growth _____ Growth Rate ___ Per . 1000

Total _____

POPULATION GROWTH = _____

_____

BIRTH RATE MEANS _____

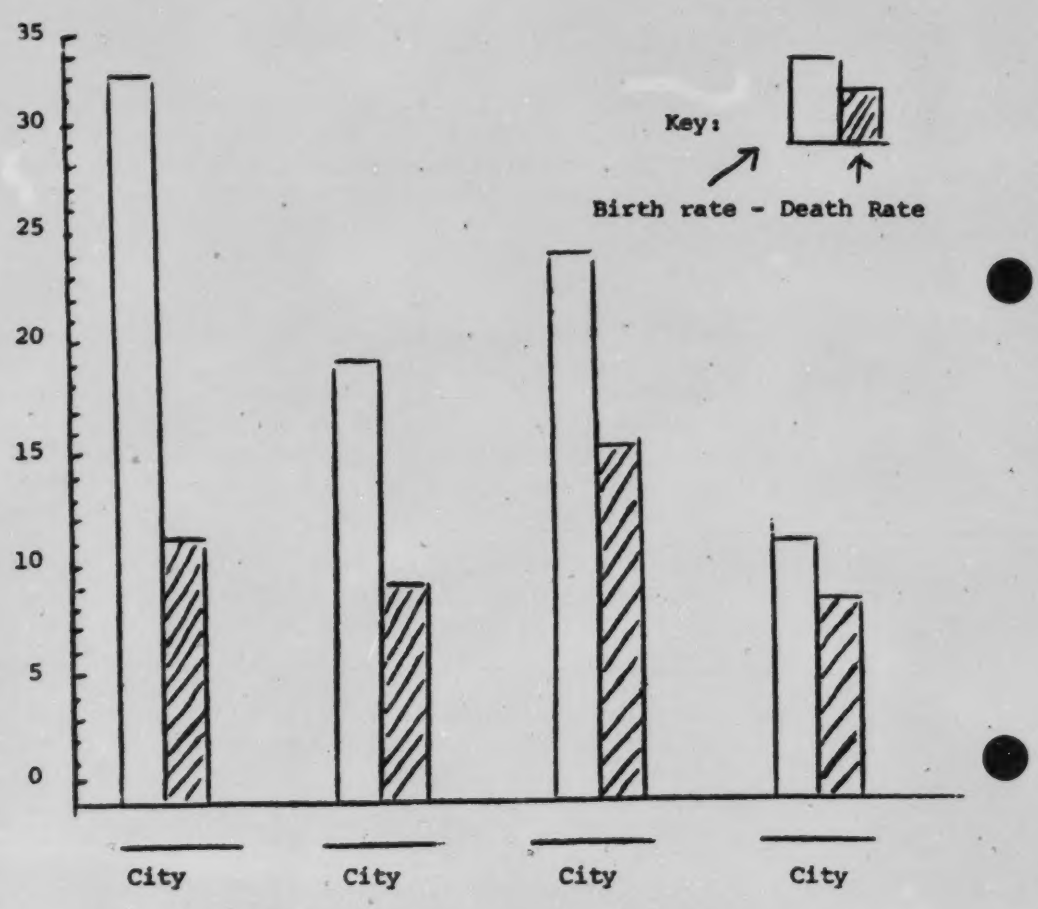
DEATH RATE MEANS _____

POPULATION GROWTH Rate = _____

_____

The Situation:

Your hard-working assistant made up a graph on birth and death rates in Center City, Jackson City, Fun City and Far City. However, your assistant is also forgetful. He made the graph, but he can't remember which city goes with which birth and death rates. Here is his graph:



How can you tell the growth rate from your assistant's graph?

What city is growing fastest?

What city is growing slowest?

EPISODE THREE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends and Changes

Topic: Doing the Demography - School

Objective: Pupils should be able to define migration and relate it to population growth.

Materials:
1. chart paper
2. graph paper

Discussion: This episode focuses on the terms in-migration and out-migration. In ascertaining population growth for a specific area, these variables must also be taken into account. Growth is defined as the sum of births and in-migration minus the sum of deaths and out-migration. Take time to discuss with pupils reasons for migration and its impact on school growth.

Secondly, this episode presents the term census and gives the students an opportunity to conduct a census. Relate this to the National Census as the method of gaining information on population growth. The enclosed booklet "People" helps to explain the census. One group or student might like to make a chart showing the kinds of information a census supplies (population growth, distribution, density, income, migration, etc.)

Definition of census - (See Glossary)

Beginning:

Discuss the school population. Hypothesize as to whether school population is growing. Give reasons.

Discuss taking a census of school. Arrive at variables. (While there will be no births, there may be deaths. If there has been a death, it might be good to explore feelings, to relate figures to real people.) Finally, to figure school growth, class will have to consider in and out-migration. (Clarify terms "in-migration" and "out-migration".

Have children check office for information on:

School Population - September, 1972 Births - Deaths
1972 - 1973 In-Migration, Out-Migration

School Population - June, 1973 Deaths, Growth

Make a chart on above.

Beginning: (continued)

Do the same for June 1973 to September 1973. Have pupils arrive at how to figure growth, that is:

(Births + In-migration)

\- (Deaths + Out-migration)

Growth

Continuing:

Either get same information for September 1973 to present from office or, even better, have students do census of school - check each teacher for September, 1973 roll, in and out-migration, deaths, and collect to ascertain total school growth.

Discuss school growth, stability, or decline. Find reasons. How is school growth related to growth of t Baltimore area? If there is urban renewal, where do migrating students go? They don't just disappear. I your school receiving migrants or sending out migrant

Following Through:

Have class graph in-out-migration, to show school growth. (Graphs will be similar to Episode II graphs.

Have class graph growth for Baltimore City school pop lation. The graph will be a bar graph with one bar indicating the number of new students entering the school and the other indicating the number of old stu dents leaving the school.

EPISODE FOUR

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Carrying Capacity and Optimum Population

Objective: Pupils should be able to define "carrying capacity" and "optimum".

Materials:
1. picture: telephone booth stuffing
2. house plan sheet
3. world population sheet
4. stickers (stars, circles ---)

Discussion: This episode introduces and explores two concepts which are at the heart of the population debate. Both are a challenge to the notion that growth is good and inevitable. The carrying capacity of an environment can be measured in terms of the maximum population supportable and sustainable by the environment. As an example, suppose a given area can supply one hundred people with just enough food to live. Its carrying capacity, then, is one hundred people. Suppose, however, one hundred ten people inhabited the area. One of two things could happen. First, those persons not getting enough food would die. (Note: Given our example in which each of the one hundred people was getting only enough to live, it would not be possible to divide the food any further. Obviously, then, the problem would be who and how many people would get that minimum.)

Secondly, the one hundred ten people might somehow be able to grow more food. However, the area can only support and sustain the food needs of one hundred people. Growing more food would then begin to destroy the environment, using up the soil's ability to produce. Soon, then, the area would no longer be able to support even one hundred people. The Dust Bowl is an example of environmental overload in which the productive capacity of the land was destroyed. Luckily, however, people could move elsewhere, and the United States could grow enough food without using the Dust Bowl land. By letting the land lie fallow and planting trees as windbreaks, the U.S. was able to restore the land to productive use. Obviously, this is not possible on a world level. If the world's environment is overloaded and its productivity destroyed, there is no other place to move while the environment renews itself.

Episode Four

Carrying capacity, then, is a concept of balance, balance between population and environment. This balance is natural for animals. If there isn't enough food to support a given animal population, then many of the animals simply die from starvation. Unlike people, animals are not able to alter the environment so as to provide themselves with more food. Only people have the ability to alter the environment to the point that it cannot support life. On the other hand, only people have the ability to understand carrying capacity and achieve a balance which does not require starvation as the method for keeping that balance.

Finally, the carrying capacity of a given environment depends on what one defines as necessary for the population. Obviously, if the population's need is defined as merely enough food to exist, then the carrying capacity of the world is much greater than it would be if the population's need were defined as enough food to constitute a healthy diet. As the question of population passes from mere survival to questions of quality of life, the concept passes from carrying capacity to optimum population. Optimum population is the most desirable population for a given environment. Optimum population might be thought of as an environment's carrying capacity given some value other than mere survival. Carrying capacity, then, refers to the ultimate limit of population size. Optimum population refers to any idea of best population size short of the limit. It might be worth noting here that it is estimated that about two-thirds of the world's present population is either undernourished or malnourished.

Beginning:

Telephone booth stuffing picture: introduce term "carrying capacity" (most people a given area can support).

Then define and discuss optimum population of telephone booth (most desirable number of people; optimum will probably be one).

Discuss carrying capacity of classroom (although exact figure unknown, room can hold only a certain volume and/or weight; room size does not change, therefore limited, finite carrying capacity).

Have class discuss what they think would be optimum population of classroom and give reasons. Discuss effect of values on optimum population (values determine one's idea of optimum population).

Continuing: House Plan Sheet (see p. 28)

Discuss and have students do plans.

Discuss question at bottom of sheet.

Now, make comparison on board or chart between Earth on the one hand and telephone booth, room, and house on the other. (Similarity - all have fixed, limited, and finite size. Difference - unlike booth, room, and house, you can't leave Earth to live somewhere else.)

Apply term "carrying capacity" to Earth. Why is carrying capacity limited? (Earth is finite; therefore, resources, food, etc. are limited.)

Discuss "optimum population". How is this different from carrying capacity? List values students hold for people that would make optimum population different from carrying capacity. (Healthy diet, good house, education, etc.) You might have a debate among students as to what people really should have - physically, economically, psychologically, and environmentally.

Following Through: Give class "World Population Sheet".

Using stickers (stars, circles, or whatever), have class place stickers on globe or map to indicate population of each area in 1971. Each sticker could represent 10 million people. Then, using another color sticker, have pupils place additional stickers to bring population for each area to the estimate for the year 2000.

In order to handle these large numbers, have pupils place stickers by counting by 10 million, 20 million, 30 million, etc. - and placing a sticker for each 10 million.

Upon completion, discuss (sample questions):

What region has the most people?
Which region is growing fastest?
What demands will new people make?
How does this activity relate to carrying capacity?
What region seems to have the most room for its population?

Additional Activities:

Collect newspaper articles on population problems for each area.

Research and compare life-styles in different areas. Which areas do not seem to be able to supply those things which students feel people should have? Why do they think this is the situation?

Episode Four

WORLD POPULATION

Area	1971	(Estimated) 2000
World	3,700	6,500
Asia	2,100	3,800
Europe	407	370
USSR	250	330
Africa	350	320
North America	230	330
Latin America	290	650
Oceania	20	35

TELEPHONE
TELEPHONE

EPISODE FIVE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Distribution

Objective: Pupils should be able to define "distribution" and identify at least three possible reasons for the current distribution of the population of the United States.

Materials:
1. graph paper
2. chart paper
3. toothpicks
4. world map
5. almanac
6. The Urbanizing United States (1800-1970)

Discussion: This episode focuses on distribution, especially in terms of the class. Basically, the United States' population is concentrated into urban areas. About 70% of the people live on 2% of the land, mainly along the east and west coasts and the Great Lakes. In 1920, on the other hand, only 51% of the people lived in urban areas. It is this change in distribution (urbanization) which this episode covers and applies directly to the students.

Beginning:

Introduce the terms "urban" and "rural" and have pupils apply them to cities and suburbs (urban) and to pictures of farms and small towns (rural).

Class Survey: Find number of class members born in urban Baltimore and number born in other places. Find same figure for parents.

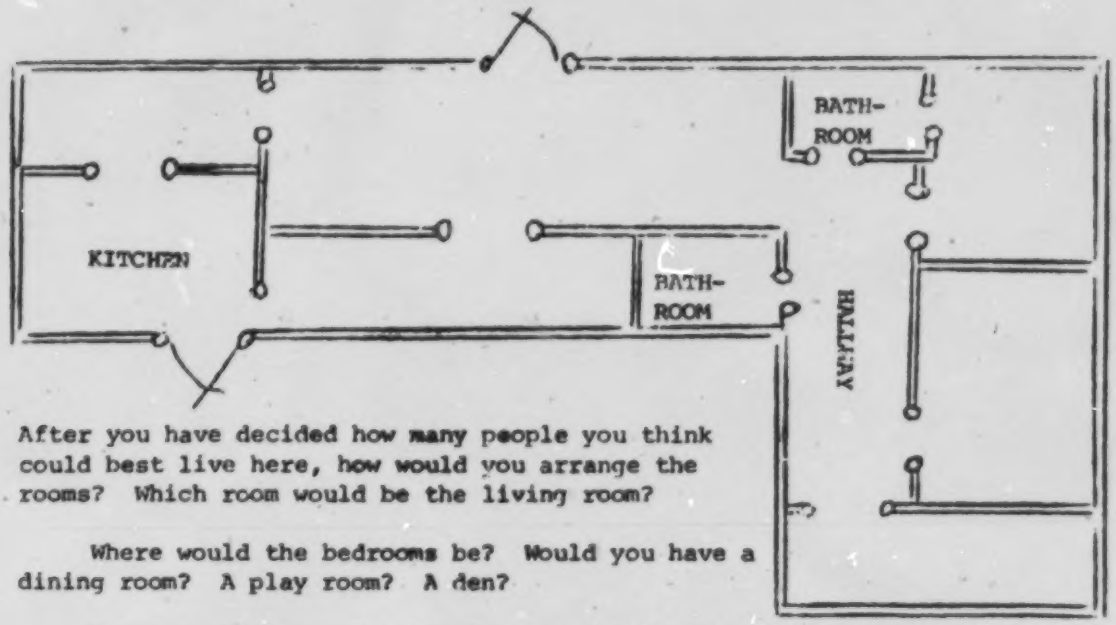
Have class look for pattern - migration from rural areas, especially South, to city (if not children themselves, then often parents have migrated to city). Investigate possible reasons with class. Class may conduct interviews at home or with neighbors to find more information here.

From this survey, have class hypothesize as to distribution of population in the United States (more and more greater percentages of people concentrating in urban areas)

Checking the hypothesis: On overhead, show graph of urban-rural percentages. Discuss: historical trend, immigration to cities.

CARRYING CAPACITY & OPTIMUM POPULATION

Here is the plan of a house. What do you think would be optimum population of this house? In other words, what do you think would be the best number of people to live in this house?

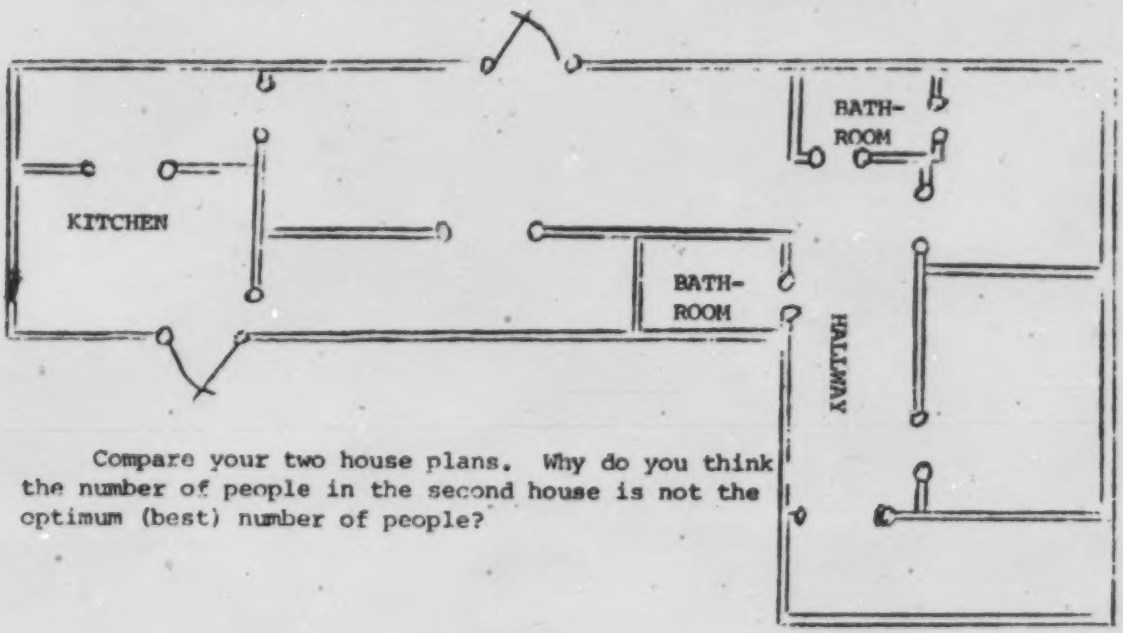


After you have decided how many people you think could best live here, how would you arrange the rooms? Which room would be the living room?

Where would the bedrooms be? Would you have a dining room? A play room? A den?

Label each room. For the bedrooms, tell who would sleep in each one. Draw in furniture in each room. What would you have in each room?

Now, suppose three more people moved in. How would you have to change the rooms to take care of three more people? On the house plan below, show how you would change your house now. Who would sleep where?



Compare your two house plans. Why do you think the number of people in the second house is not the optimum (best) number of people?

Episode Five

Following Through:

Seventy percent of the people in the United States live on 2% of the land. The remaining 30% of the people live on 98% of the land.

Have pupils mark off a 10 by 10 square on graph paper. Mark off two squares, put 70 dots in those squares (i.e., 70% of the people on 2% of the land). Put 30 dots on the remaining area (98 squares). Explain percentage, (i.e., 70% of the people would mean 70 out of every 100 people).

With the United States map, brainstorm and list with class the possible reasons for this distribution. (non-usable areas, deserts, mountains; attraction of cities and coasts; land needed in farming - hence, smaller number of people can live there).

THE URBANIZING UNITED STATES
(1800-1970)

YEAR	URBAN	%	RURAL	%	TOTAL
1800	300,000	6	5,000,000	94	5,300,000
1830	1,000,000	9	12,000,000	91	13,000,000
1860	6,000,000	20	25,000,000	80	31,000,000
1890	22,000,000	35	41,000,000	65	63,000,000
1920	54,000,000	51	51,000,000	49	105,000,000
1950	97,000,000	64	54,000,000	36	151,000,000
1970	149,000,000	74	54,000,000	26	203,000,000

Episode Five

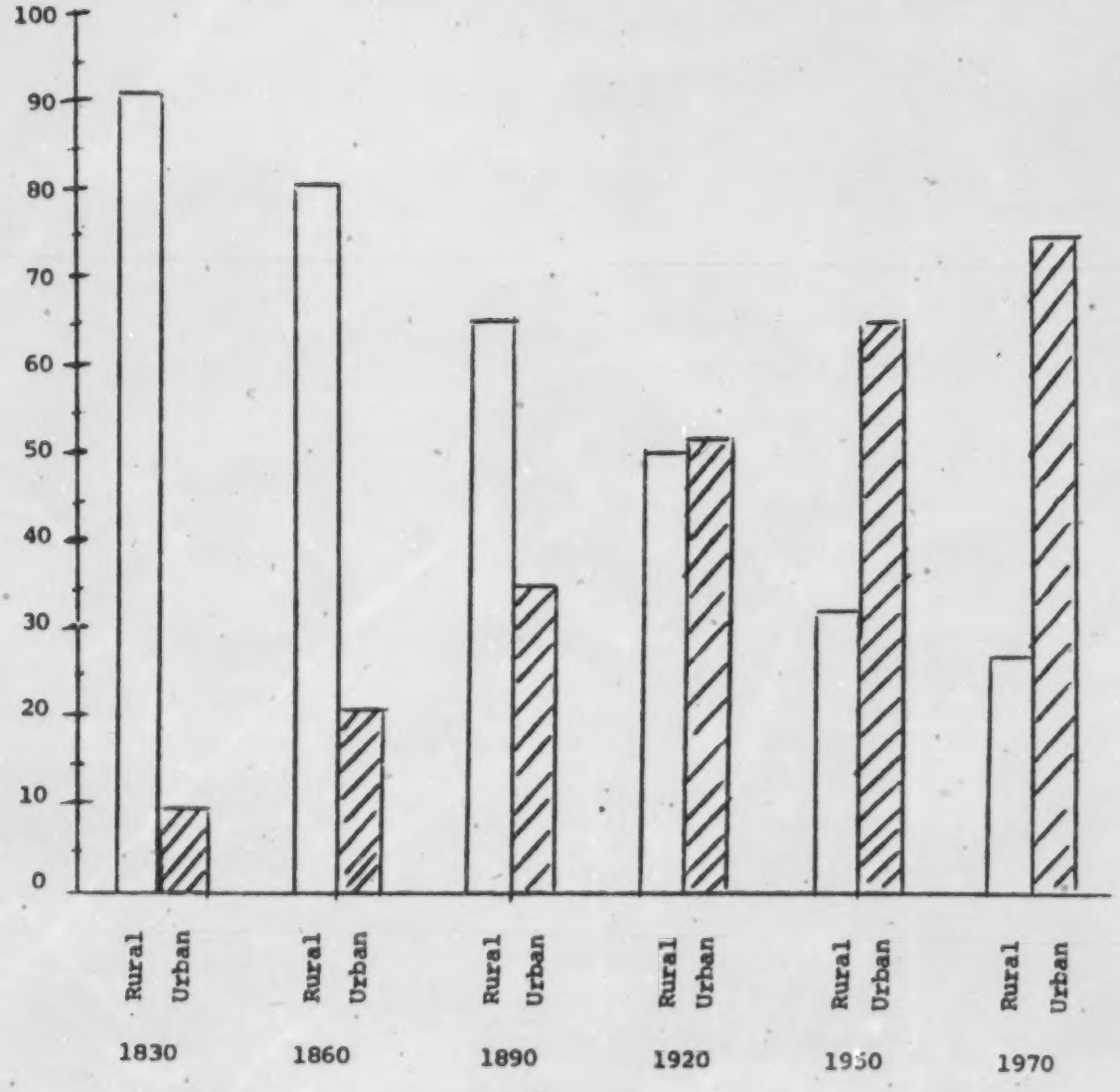
YEAR	RURAL	URBAN	TOTAL U.S. POPULATION
1830	12,000,000	1,000,000	13,000,000
1860	25,000,000	6,000,000	31,000,000
1890	41,000,000	22,000,000	63,000,000
1920	51,000,000	54,000,000	105,000,000
1950	54,000,000	97,000,000	151,000,000
1970	54,000,000	149,000,000	203,000,000

* The above figures taken from Kathryn Horsley, Environment and Population, National Education Association, Washington, D.C., 1972, p. 54.

Episode Ten

DISTRIBUTION: UNITED STATES

Where does most of the population live - Urban Areas or Rural Areas?



EPISODE SIX

Unit: Population - Demography: Investigating Population Growth, Composition, Trends and Changes

Topic: Doing the Demography - Density

Objective: Pupils should be able to define "density" and interpret density per square mile.

Materials:
1. graph paper
2. transparency - "Graph of Densities"
3. chart paper
4. toothpicks
5. world map
6. clay and clay boards

Discussion: This episode focuses on the concept of density and some possible effects. Density refers to the average number of people per square mile, in demographic terms. In terms of past episodes, higher density is a product of migration to cities as well as the rate of natural increase. As a result a greater percentage of the United States' population now live in urban areas with high densities. Secondly, as important as density itself, is the phenomenon of urban sprawl (high density areas expanding further and further outward). The coming Boston-Washington megalopolis is an example of this, a densely populated area hundreds of miles long. Obviously, then, whatever effects density can have are multiplied by the size of the area of high density.

Beginning: Teach concept of square mile and density.

You might do this by using squares on board and stick figures ( ) to show different densities, or you might make equal squares on the floor and have different numbers of children stand in each, then discuss which squares are more densely populated.

Continuing:

Have pupils mark off 20 square by 35 square rectangle on graph paper. Inside this rectangle mark off a 10 by 8 rectangle. The inner rectangle represents Baltimore City, the rest of the large rectangle represents Baltimore County. Have pupils label and lightly color in these areas. With pupils, note Baltimore City equals 80 squares, Baltimore County equals 620 squares. Relate this to area of Baltimore City: about 80 square miles; to Baltimore County: about 620 square miles.

Episode Six

Now relate to pupils the population of Baltimore City - about 900,000 people; Baltimore County - about 600,000 people.

Have pupils count by 10,000's and place a stick figure ( ) for each 10,000 people within the city portion. Then do the same for county. Pupils now have a pictograph of city and county density. Have pupils decide which is more dense (focus on meaning of density: the more people per square, the more per square mile and, therefore, the greater the density).

Show graph of densities on overhead:
City: 11,000 people per square mile
County: 1,000 people per square mile

Optional: Discuss and put on chart the following in terms of density:

Housing	Roads and Traffic	Noise	Pollution	School
Types Numbers	Types, Amount	Amount Effect	Amount - Ways of Coping	

Crime	Privacy	Entertainment

(This should be as descriptive as possible, avoiding propaganda.)

Following Through:

Using density figures for continents, mark off equal squares in clay on board (or cardboard) or use separate boards.

Each square or board will represent one square mile of each continent.

Have students place a toothpick in the square for each continent, for each person per square mile.

Discuss differences, highest, lowest densities, etc.

Using world map, have pupils figure why Asia has a larger population even though Europe is more dense (muc larger land area).

DENSITIES OF MAJOR LAND AREAS

LAND AREA	NUMBER OF PEOPLE PER SQUARE MILE
Asia	193
Africa	30
North America	34
South America	28
Europe	243
Oceania	6
USSR	28
World	62

Source: 1973 Information Please Alamanac

Pupils might want to use this Almanac to research the densities of various countries, to find the most dense and the least dense, etc.

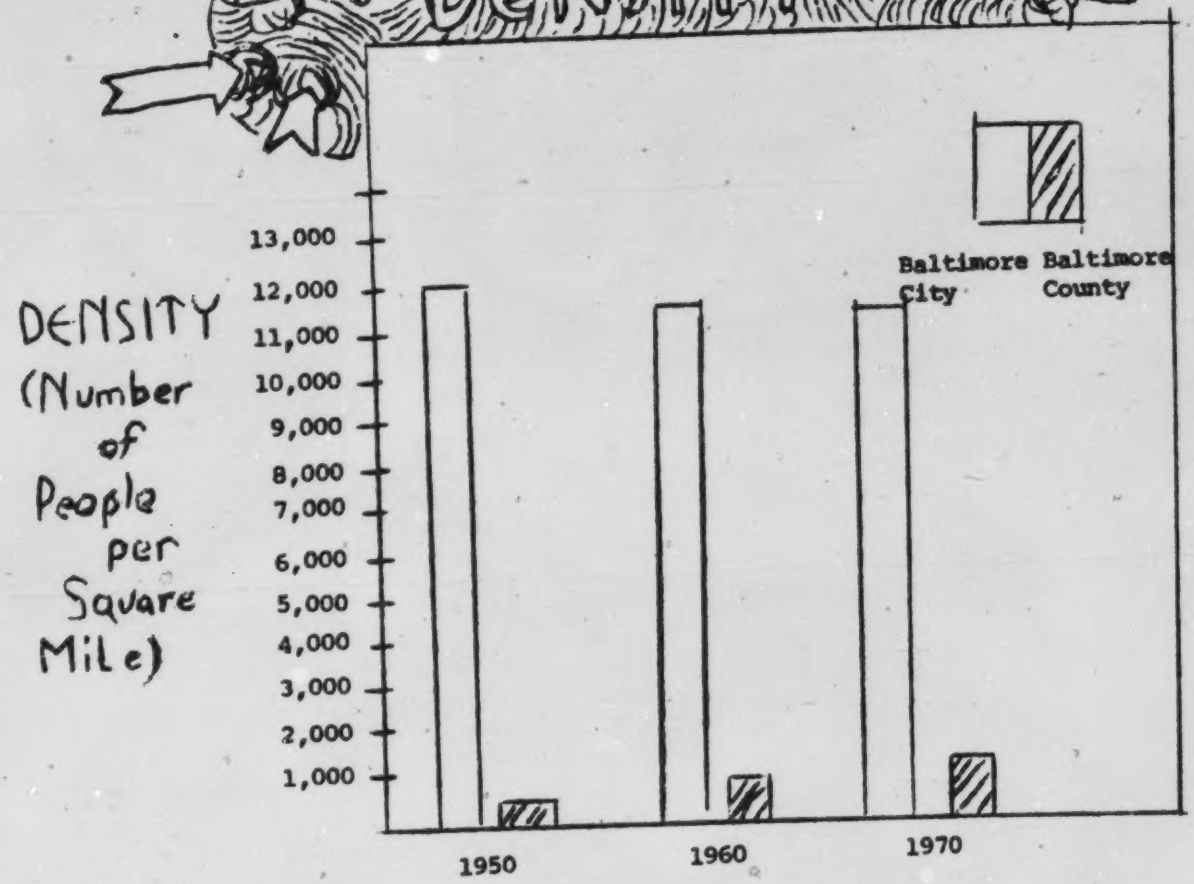
POPULATION DENSITY OF THE CONTINENTS

Estimated number of persons per square mile in 1972

Population	Continent	Persons per Sq. Mile
659,000,000	Europe	162
2,173,000,000	Asia	128
329,000,000	North America	35
370,000,000	Africa	32
201,000,000	South America	29
13,000,000	Australia	4

(Antarctica has no permanent population.)

Source: Statistical Yearbook, 1969, U.N.



	NUMBER OF PEOPLE PER SQUARE MILE
Baltimore City	
Baltimore County 1950	
Baltimore City	
Baltimore County 1960	
Baltimore City	
Baltimore County 1970	

= 1,000 People

EPISODE SEVEN

Unit: Population - Demography: Investigating Population Growth, Composition, Trends and Changes

Topic: Doing the Demography - Age Structure

Objective: Pupils should be able to define "age structure", conduct a census of a given area and graph data from census.

Materials: 1. graph paper or story paper
2. transparency - graphs of India and Sweden

Discussion: This episode focuses on the age structure of a population and some of its implications. Age structure refers to the number of people within various age groupings, i.e., the number of people, 0-4, 5-9, 10-14, 15-19, etc. For example, if the age structure shows a large number of children 0-4 years in age, then it will be necessary for the society to immediately begin planning and constructing schools to accommodate those children as they become older.

Another consideration in which age structure is important is the ratio of dependent population to productive population. In the United States, it seems fair to consider those persons under 20 as dependent upon parents and society for support (monetary, educational, etc.) It also seems fair to consider those over 65 as dependent. Those from 20 to 65 may be considered as productive in terms of taxes, care, services, etc. These people usually can work to support themselves and their families, if they have them. Obviously, the more productive people there are in relation to dependent people, the more people-resources the society has to cope with problems and to expend on the dependent population (education, health care, social programs, etc.) On a personal level, an analogy may be made in the following terms. Family A consists of a husband and wife and two children. Family B consists of a husband and wife, and an 85 year old grandmother, and four children. Family B has a higher ratio of dependency. As a result, if family A and B have the same income, family B will probably have a much more difficult time meeting its resource needs.

Age structure can also show how fast a population is growing. Compare the age structure graphs for India and Sweden. The disproportionately large number of young people shown by the graph on India shows population is growing rapidly now and will continue to grow as this large number of young people reach maturity and have children. The graph on Sweden, on the other hand, shows a very slowly growing population, with the number of people in each age group quite similar. In short, the Swedish are basically quite closs to simply replacing themselves. (We remember that the growth rate is a function of the number of births, deaths, and net migration. Of course, a high birth rate will not necessarily indicate a high rate of growth unless the death rate is considerably lower than the birth rate.)

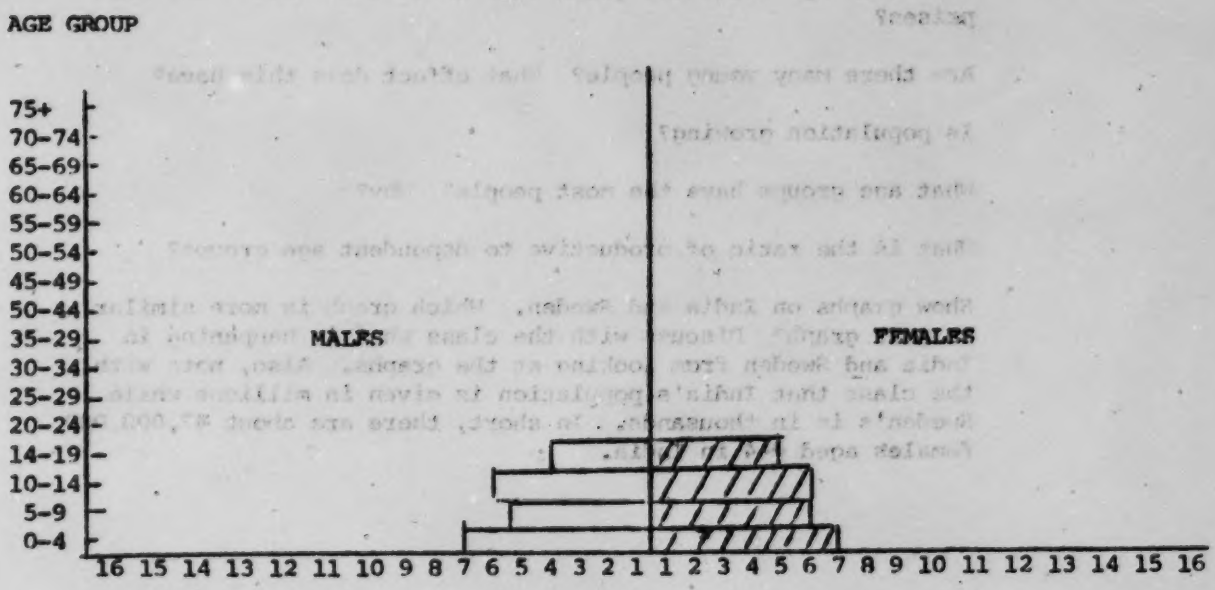
Beginning:

Students select one block near home or teacher selects one block near school for each class as the basis for making an age structure graph. Have the class do a census of the block, recording age group for each inhabitant. (See attached sheet) The "Census taker" puts in a mark in each age group for each person of that age group that he counts. Divide the block into smaller units and assign census taking for these smaller units to groups in the class.

After the pupils have counted the census, collect all data for the block and put on one sheet.

Continuing:

Now the class is ready to make an age structure graph. This may be put on story paper. The graph should look something like this.



Episode Seven

So far, the graph shows:

7 males	-	0-4 years
7 females	-	0-4 years
5 males	-	5-9 years
6 females	-	5-9 years
6 males	-	10-14 years
6 females	-	10-14 years
4 males	-	15-19 years
5 females	-	15-19 years

Your numbers may be larger.

Following Through:

When the graph is finished, discuss and record observations with the class.

What does age structure graph show about the block? Any surprises?

Are there many young people? What effect does this have?

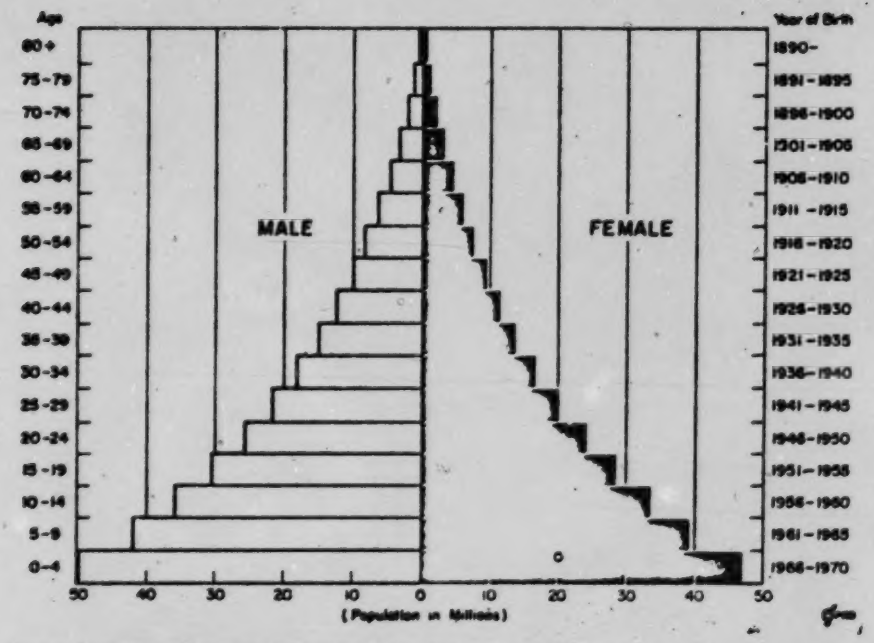
Is population growing?

What age groups have the most people? Why?

What is the ratio of productive to dependent age groups?

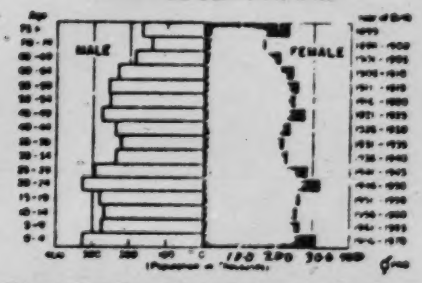
Show graphs on India and Sweden. Which graph is more similar to your graph? Discuss with the class what is happening in India and Sweden from looking at the graphs. Also, note with the class that India's population is given in millions while Sweden's is in thousands. In short, there are about 47,000,000 females aged 0-4 in India.

INDIA: 1970 POPULATION BY AGE AND SEX



Source: International Demographic Statistics Center. U.S. Bureau of the Census.

SWEDEN: 1970 AGE-SEX PYRAMID



Source: UN Population Division. Working Paper No. 11.

AGE STRUCTURE CENSUS SHEET

	MALES	FEMALES
0-4		
5-9		
10-14		
15-19		
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		
50-54		
55-59		
60-64		
65-69		
70-74		
75+		

Note to Census-Taker: For each house surveyed, put a mark (1) in the correct age group for each person who lives there. Don't forget to put males in the first column and females in the second column.

EPISODE EIGHT

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: Doing the Demography - Number of Children and Population Growth

Objective: Pupils should be able to observe and identify at least 2 consequences of different sizes of families on future population.

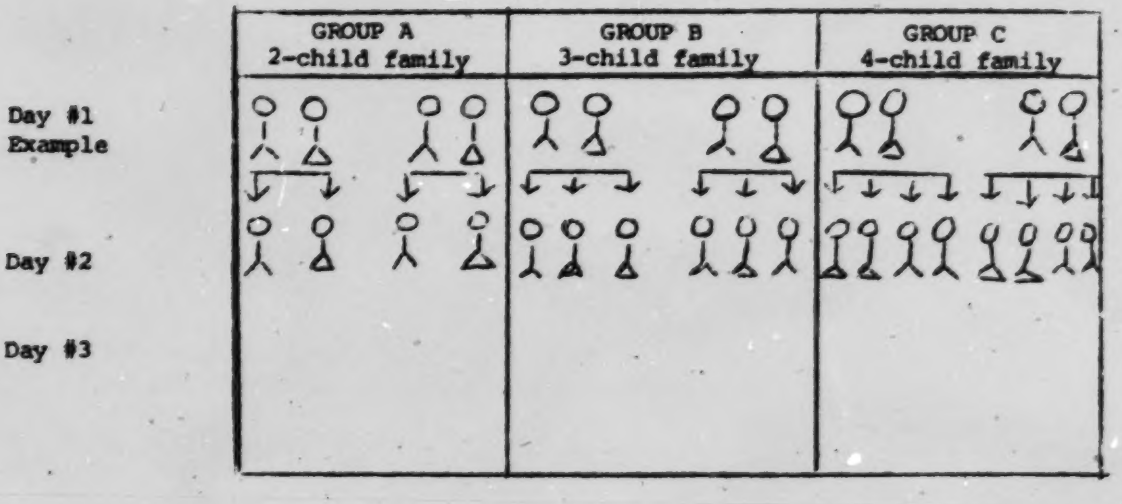
Materials: Magazine pictures of people

Discussion

This episode focuses on the idea that personal decisions have demographic consequences by examining the effect of two, three, and four child families on population growth. This lesson should be future-oriented, that is, the effect of future family size on future population growth. This lesson is not intended to set up a norm for family size, but only to observe the effects of different family sizes; that is, to provide information, not to encourage a specific decision.

Beginning:

Start off on the board with magazine cut-out pictures of people in three groups. Or you could have pupils do stick figure drawings and cut them out. Either way, have pupils supply the pictures. You will need thirty figures the first day. Arrange the board in the following way (figures should be in couples):



On Day #1, each couple in Group A has 2 children.
each couple in Group B has 3 children.
each couple in Group C has 4 children.

(Make more cut-outs)

Episode Eight

Now find total number of children for each group:

A-4
B-6
C-8

On Day #2, arrange children from Day #1 into couples. Each couple then has children, the number of which depends on the group the couple is in.

Group A-2
Group B-3
Group C-4
(Make more cut-outs.)

Now find total number of children born into each group on Day #2.

A-4
B-9
C-16

On Day #3, arrange children from Day #2 into couples and have each couple have children, the number of which again depends on the group to which the couple belongs. (Note: one person in Group B will have to remain unmarried - no children.)

Figure the total number of children for Day #3 for each group.

A-4
B-12
C-32
(On Day #3 you will obviously need many more cut-outs.)

Discuss with class the effects of 2, 3, and 4-child families on population growth.

Have them explain as well as possible why the population grew so much faster with a four child family.

If you wish, go on to Day #4 and #5. Have class make predictions. Pupils could also graph growth, showing population for Day #1, Day #2, etc.)

EPISODE NINE

Unit: Population - Demography: Investigating Population Growth, Composition, Trends, and Changes

Topic: A Continuing Activity

Objective: Pupils should be able to construct a display using data interpreted from graphs, arithmetic computation, and predicted growth.

Materials:
1. bottle tops
2. aquarium
3. flat box
4. toothpicks

Discussion: This activity involves the setting up of a model for investigating population growth in relationship to the carrying capacity of the environment. As an analogy to Earth, it is important to remember that the "environment" used for the model cannot be exchanged for a larger one. The only variables are birth and death rates as migration does not affect the world's population. This model allows the class to observe and graph a population explosion, to see how population growth multiplies itself by providing an ever larger population for the growth rate to act on. The model also gives students a chance to observe different growth rates and/or seek solutions to the problem of over-running the environment's carrying capacity. For those doing this activity as part of the Environment Earth section, it is suggested that they do follow-through activity number three also. This activity might be one you wish to do as soon as the class enters each morning as a before nine o'clock activity.

NOTE: This episode is to be the last episode for both the Demography section and the Environment Earth section. Everything is the same except for the episode number.

Activity:

The term environment is introduced and applied to the box or aquarium. Bottle tops are introduced as symbols for people (or other living things). Aquarium is introduced as analogous to earth, specifically the biosphere, and life beyond the aquarium is understood as impossible (no air, food, etc.).

Four bottle tops are introduced (i.e., 2 families). A growth rate is established (e.g., 3 "children" per "family", 1 "death" per "family" per day). Births mean new bottle tops are added; deaths mean bottle tops are removed. Each day may be thought of as a ten or twenty year period, if desired.

Episode Nine

Day #1 - 6 "births", 2 "deaths"
birth rate 15/1000 per day

death rate 5/1000 per day

Growth rate 100% (1000 new people per 1000)
Absolute growth 1st day = 4 population = 8
(number of new people)

Day #2 - Growth rate remains same throughout.
Growth = 8 population = 16

Day #3 - Growth = 16 population = 32

Day #4 - Growth = 32 population = 64

Day #5 - Growth = 64 population = 128

etc.

Growth continues until population reaches carrying capacity and bottle tops begin falling out of aquarium (i.e., People die because biosphere can no longer support them - no air, food, etc. left for new people.)

Continue analogy with Earth and its carrying capacity.

Following Through:

1. Compute days required to reach carrying capacity and try the same experiment with lower and higher growth rates and compare lengths of time to reach carrying capacity.

2. Try to find solutions (pupils may suggest equalling out birth and death rates); a larger container will not be allowed.

3. Try the same experiment using a flat box as the environment, food and buildings for housing. For example, each bottle top might need one toothpick to eat each day and a match-box house for every four people (bottle tops). Capacity would be reached when there is no longer any room to "grow" toothpicks (this growing could be done by placing toothpicks side by side to represent a crop needing space to grow) and match-boxes start falling when placed on top of each other.

NOTE: Students would graph each day's growth on a large sheet in order to visualize and see the geometric progression.

Topic: Population - Investigating Human Factors and Consequences

Sub-Topic: Population and Environment Earth

Concept:

A. "You can never do merely one thing."

B. "You can't get something for nothing."

C. Man is dependent on a limited, finite environment, "Spaceship Earth".

D. Man's environment consists of several interrelated environments:

1. Natural: (Earth - its space, its resources, its necessities for life)

2. Man-made physical: (architecture, transportation, patterns, etc.)

3. Cultural and Social: (values, assumptions, other men)

E. Man's life includes quality and quantity dimensions, both of which are affected by population growth, composition and distribution, and which are limited by the resources and space of Spaceship Earth.

OUTLINE OF EPISODES

CONCEPTS AND VOCABULARY

Episodes	Concepts	Vocabulary (Generalizations)
Episode I	C	Spaceship Earth environment finite carrying capacity physical needs psychological needs
Episode II	A, B	products factory pollution effects
Episode III	D	natural environment man-made physical environment cultural environment effects
Episode IV	A,B,C,D	food chain nutrients environment dependent chlorophyll
Episode V	A,D	run-off metropolitan area suburbs urban planning trade-off
Episode VI	E,C	measured water usage irrigation quantity technology finite
Episode VII	E,D	quality "away" water pollution
Episode VIII	D,E	conflict trade-off man-made environment values quality
Episode IX	C,E	environment birth rate death rate growth rate population

GLOSSARY

Carrying Capacity .... the maximum sustainable size of resident population in a given ecosystem

Conflict ..... opposition between ideas, needs, desires, etc.

Environment ..... the aggregate of all the external conditions and influences affecting life development and, ultimately, the survival of an organism

Food Chain ..... any one sequence of species through which material and energy passes

Growth ..... increase in population in absolute numbers

Man-Made Physical ... all the material things that man makes, e.g., buildings, tools, roads, machines

Nutrient ..... a substance providing nourishment; or a substance providing sustenance

Physical ..... of or pertaining to that which is material; non-living

Pollutants ..... that which makes things foul or unclean, dirty

Population ..... the total number of persons (or units of something, such as rocks) inhabiting a specific area

Psychological ..... dealing with, or affecting, the mind, esp. as a function of awareness, feeling or motivation

Quality ..... grade of excellence, fineness

Quantity ..... pertaining to the number or amount of something

Run-Off ..... rain water which drains off

Rural ..... the country as opposed to the city

Soil ..... the portion of the earth's surface consisting of disintegrated rocks and humus - some of which is capable of producing vegetation; source of nutrients for vegetation

Suburban Area ..... a district lying immediately outside a city; outside the geographical boundaries of the city

Taxes ..... a sum of money demanded by a government for its support of specific facilities or services, levied upon property, sales, etc.

GLOSSARY (continued)

Technology ..... engineering, applied science, industrial arts, etc and their products

Trade-Off ..... an exchange, e.g., the convenience of a large car and air pollution. You gain comfort and the abili ty to get around quickly and luxuriously, but you give up cleaner air. In short, you can't get one thing without giving up another.

Urban ..... pertaining to a city or a large town

EPISODE ONE

Unit: Population and Environment Earth

Topic: "Spaceship Earth"

Objective: Pupils should be able to identify needs of people within a finite environment.

Materials:
1. sheet - "Spaceship Terra - The Long Journey" (stencil)
2. Apollo pictures of Earth (or globe)
3. chart pictures

Discussion: This episode draws the analogy between a spaceship and Earth. A livable spaceship is simply an example of man carrying his environment with him. Without a sustaining biological and physical environment, there is no man. The spaceship example is merely a way of making concrete several points about Earth - that Earth is finite; that Earth is the only home man has (the Greek root of ecology, "ecose", means "home"); and, finally, because of its finitude, Earth has a limited carrying capacity. Suppose, however, for a moment, that there was some other planet on which people could live. At present growth rates, about 70 million per year would have to be blasted off to that other planet in order to keep the world population at its current size. This is only another way of saying that Earth is man's home, and there is no running away from home for mankind.

Beginning:

Have pupils read "Spaceship Terra - The Long Journey" (stencil). Clarify terms - psychological needs, physical needs.

Have pupils in group plan needs and list in spaceship; then design the spaceship.

Come together as a group and discuss. Were any needs left out? What does the group consider to be needs under each category - physical and psychological?

Continuing:

The Analogy - Show another "spaceship" - Earth (either picture of Earth or a globe). (Use Apollo pictures of Earth. These should be in the school picture packet on space.)

Make comparisons and chart.

Episode One

Earth	Spaceship
moves through space	
finite, limited	
no change in size	
no new resources	
needs similar	
man can't leave	
etc.	

Chart differences, such as size, pollution, population growth, any others.

Examine possible effects of population growth on spaceship.

Introduce terms "carrying capacity" and "spaceship". "I can carry only a limited number of people" analogy with Earth.

Concept:

"Spaceship Earth" - a finite, limited home for man which must contain all of man's needs. Have class verbalize this concept; record.

"Although science has done fantastic things, I would answer that there are things it cannot do and can never do. Science cannot add one square foot to the surface of this planet, nor can it add a ton of coal, a pound of uranium, a barrel of oil, or a glass of water." Morris K. Udall, "Spaceship Earth - Standing Room Only", The American Population Debate, Daniel Callahan, ed., p. 90.

Read with class. Ask the class to comment in terms of the lesson. (That is, science can change things, but it cannot create something from nothing. What is here is here, and that's it.)

SPACESHIP TERRA - THE LONG JOURNEY

It is the year 2020. A radio signal has been received from the star system Alpha II. World scientists think that this signal shows there is intelligent life somewhere in the universe besides Earth. The World Space Federation has decided to send a space expedition to Alpha II. The Federation has chosen you to be one of twenty crew members on this space journey to the stars.

Your first task as a crew member is a large one. You and the other members of the crew must decide what you will need on your journey. Think of your needs in two categories: 1) physical needs and 2) psychological needs. The space below has been provided for you to list your needs. Remember, your journey will take 300 years.

Physical Needs	Psychological Needs

Now that you have listed your needs, compare your list with others in your group. Remember, you are a crew working together. Discuss the needs on your list with the rest of the crew. Are there other needs which should be added? Are there any unnecessary"needs" on your list that can be taken off?

Now that your crew has arrived at its needs, how will you provide these on your spacecraft? Remember, your journey will take 300 years. Everything you need must be provided by your spaceship. Outside is only empty space.

Draw a diagram of your spaceship. Make a plan showing the inside. Show where people will sleep, where and how food will be provided, etc.

EPISODE TWO

Unit: Population and Environment Earth

Topic: The Factory: "We can never do merely one thing."
"You can't get something for nothing."

Objective: Pupils should be able to identify products and by-products of the factory in environmental terms.

Materials:
1. picture of factory
2. chart paper
3. composition paper

Discussion: This episode focuses on factories and products. Usually we think of a factory as putting out one product: a steel plant for example. We think of a factory as doing one thing. We either ignore its other products or give them a subsidiary importance by calling them by-products. A similar process occurs with drugs. Drugs have their side-effects. Again the suggestion is made that side-effects have less reality than the drug's remedial effect. The point of this episode is not that factories and drugs are bad, but rather that products and by-products, effects and side-effects are equally real. It might be better to realize products are products in order that we may make realistic decisions as to what products we want, fully aware of the fact that we are not getting something for nothing. For example, if we think of companies in terms of their actual products, we would get company titles like "Bethlehem Steel, Water Pollution and Air Pollution Company" or "Calvert Cliffs Atomic Power, Thermal Pollution, and Radioactive Wastes Plant". At least, we would be aware of the risks and trade-offs involved and of the importance and reality of all products of a factory.

Beginning:

Stenciled picture of a factory given each student.
Ask what a factory produces.
Answer: One thing in this case, steel.

Now have class look at picture as someone from another planet might, that is, with no preconceived notions. Have class now describe exactly what they see the factory producing. (We can never do merely one thing. We produce a great deal more than steel.)

Other products:
1. air pollution from steel-making process, from trucks which transport steel
2. water pollution from wastes in making steel
3. noise from machinery, trucks which transport steel

(List these on chart along with steel.)

Episode Two

Continuing:

Make a list and chart under each heading as to uses, results, and effects of each product. Have class give list in brainstorming session. Below is a sample listing

Steel	Air Pollution	Water Pollution
cars	dirty laundry	dead fish
buildings	lung problems	no swimming
etc.	watery eyes	bad smells
	climate changes (cities warmer, wind patterns change)	ugly water
		unsanitary water
		unusable water
	need to repaint, clean houses more often	
	less pretty sunsets	

Noise

hearing loss
tension
psychological effects
(e.g., a worker returning home to noisy children)

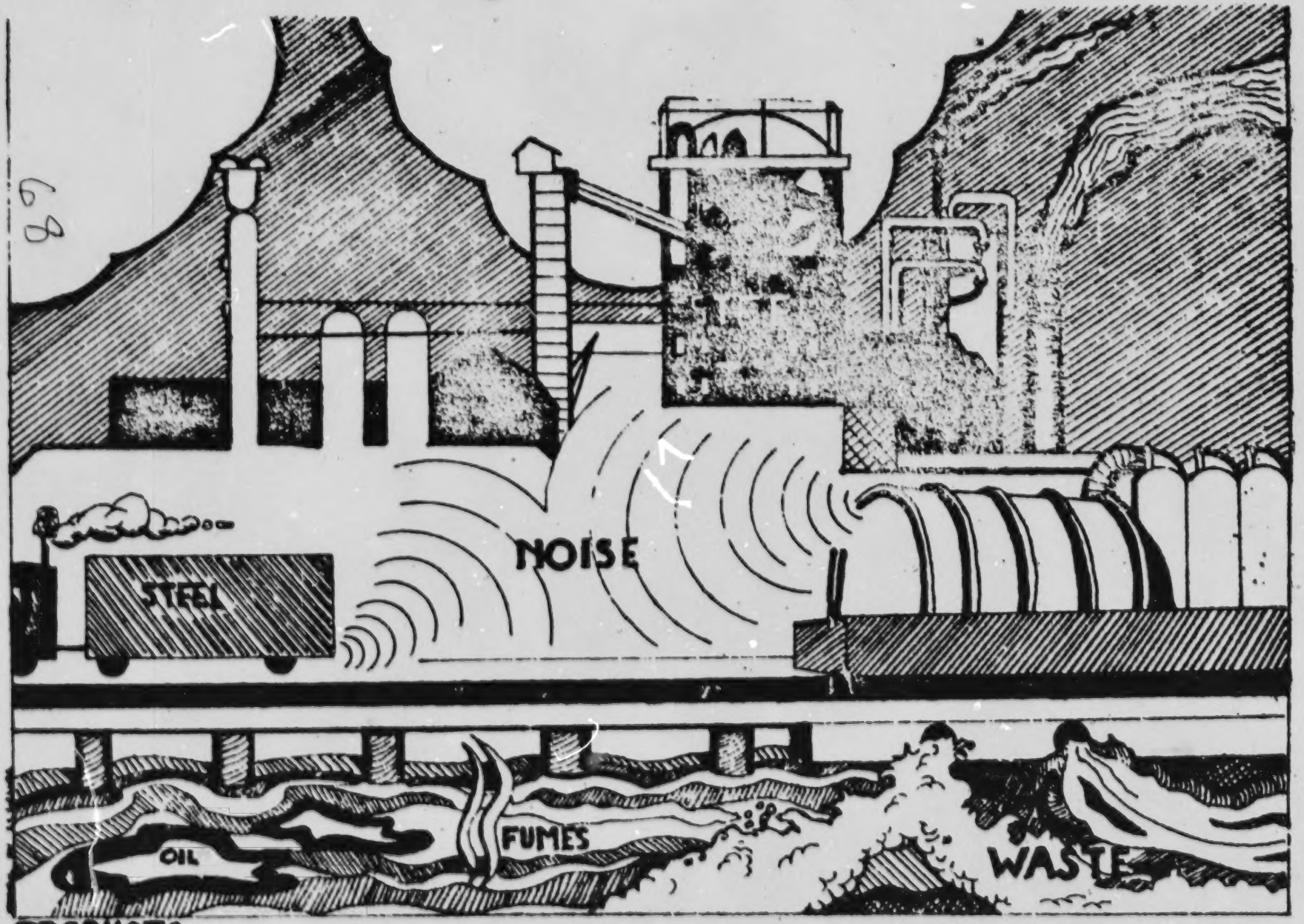
Summing Up:

Now give class this statement, "We can never do merely one thing."

Discuss applicability of this statement to factory episode. Have class give other examples. Role-play examples if possible, especially from personal experience of a time they tried to do one thing but found many other effects.

(You might bring up urban renewal as an example.) Old houses get torn down, but what happens to the people living there? Also, a need is produced to build new housing.

Students might write a short illustration of this statement: "We can never do merely one thing." Alternatively, students might do a drawing showing how "We can never do merely one thing" applying to school. In addition to education, drawings might show lunch garbage, smoke from incinerators, feelings caused by school, and any school activities which are not solely educational.



PRODUCTS: _____

EPISODE THREE

Unit: Population and Environment Earth

Topic: Types of Environments

Objective: Pupils should be able to define at least 3 kinds of environments and relate them to each other.

Materials: 1. chart paper

Discussion: This episode introduces the concepts: natural environment, man-made physical environment and cultural environment. Through an extended example, this episode explores the effects on the cultural environment of the other two. The final concept is that the three environments are interrelated. Cultural values affect the other two environments hugely. As an example, science and all the man-made physical objects it created arose out of a specific religious heritage, the Judeo-Christian, which allowed man to think of nature not as his co-equal but as his domain. Obviously, from this unit's point of view, the natural environment affects the other two by supplying and limiting their resources. This reflects back on the concepts Spaceship Earth and carrying capacity. When doing further episodes, it would be a good idea to consider with the class which environment or environments are involved in the episode.

Beginning:

Introduce the terms natural environment, man-made physical environment, and cultural environment.

Have class put each of the following under the environment of which it is a part:

car	worm	clothing style	music
grass	iron	oil	water
house	oxygen	women's lib	skyscraper
science	religion	soil	clothing
lakes	pencil	money	wool
television	steel	drugs	marriage
cans	cows	washing machine	air
art	highways	fertilizer	
law	land	school buildings	

Add others to the list with the class. (Items such as clothing style and money may arouse discussion. In as much as cash is an idea, each belongs to the category of cultural environment.)

With class, arrive at general definition of each type of environment. Cultural environment may be defined as values and assumptions, ideas of a society or group.

Episode Three

Continuing:

Begin with a value (cultural environment), such as the desire to travel and to be able to move about quickly. How does this affect the man-made physical environment? Lead the class through brainstorming possibilities.

Effect of man-made physical environment:

manufacture cars, airplanes

build factories to make cars and airplanes

build factories to make parts to build other factories

build plants to make steel for this factory

build railroads and trains to carry steel to factory

build places to sell cars

build airports for planes

(List as many others as possible.)

Now ask how these environments are related. Record answers. (Answers should show that cultural environment affects the other two environments.)

Now turn the tables. Ask for ways the natural environment affects the man-made physical and the cultural environment. You may need to take a specific example.

Final concept: The environments are interrelated. Each affects the other two.

EPISODE FOUR

Unit: Population and Environment Earth

Topic: You Are What You Eat. (All Concepts)

Objective: Pupils should be able to identify at least 1 dependent relationship between man and his environment.

Materials:
1. transparency - Plant Parts
2. transparency - Man and Food Chains

Discussion: This episode focuses on the dependent relationship of man to his physical and biological environment. First, the episode examines a plant's use of sunlight, water, and nutrients from soil or water and gasses to supply itself with energy and food. Secondly, the episode begins with man and traces three food chains down to their most basic level - water, sunlight and nutrients in soil or water. All of man's food, and thus man himself, is ultimately dependent on the supply of water, good soil, and sunlight. These basics also ultimately limit man's growth. There is only so much water, so much soil, and so much sunlight. To speak of man is to speak of food. To speak of food is to speak of water, soil and sunlight. In a limiting sense, then, man is what he eats.

Beginning:

Show transparency of Plant.

Discuss the plant's needs: sunlight, water, nutrients (minerals and gasses from soil and air).

Discuss how plant parts capture these needs and discuss especially the role of chlorophyll. (Chlorophyll takes the basic resources of sunlight, water, and nutrients from the soil and, through a chemical process, converts them into energy.)

Compare plants to animals in terms of ability to produce own food from the basics (soil, nutrients, water and sunlight); focus on animals' dependence on plants. Have class decide which came first in the history of Earth - plants or animals. (This beginning serves as a basis for the discussion of food chains.)

As a follow-up, some students might research soil to find the role of living things (worms, bacteria, etc.) in healthy soil.

Episode Four

Continuing:

Show overhead transparency of man and the food chains. Using three strips of paper, cover each of the three food chains. Uncover hamburger. Have class then supply each succeeding link. Then do same for perch and potatoes.

Have class look for common links in chains. (1. plants 2. sunlight, soil (nutrients), water)

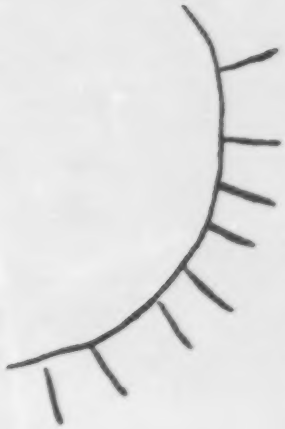
Discuss dependency of all parts of the food chain on sunlight, soil, water (especially man's dependence). How are people in cities related to soil, sunlight and water?

Ask the class to apply the statement "You can never do merely one thing" to eating a hamburger. (You are eating beef, which is, in effect, eating grass also, which is, in effect, eating sunlight, water, and soil.)

Role-playing: Have students role-play the following situations:

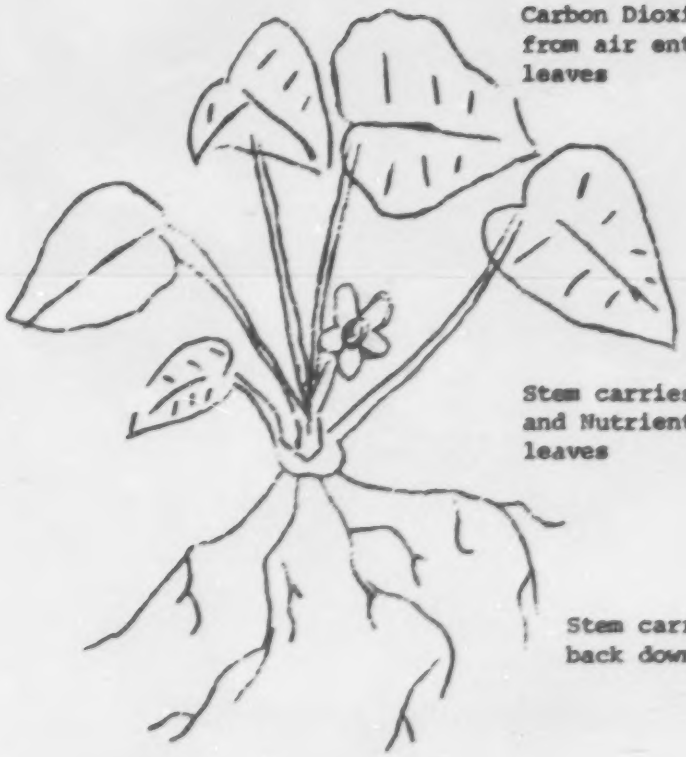
1. a farmer trying to convince a city resident that he should take an interest in soil conservation

2. a plant, a ray of sunlight, some soil,,and some water - their reactions to man; speaking to man on their role in relation to man; their reaction to growing population



HOW A PLANT MAKES FOOD

Sunlight acts on Chlorophyll in leaves to allow the plant to make food from Nutrients, water, carbon dioxide



Carbon Dioxide from air enters leaves

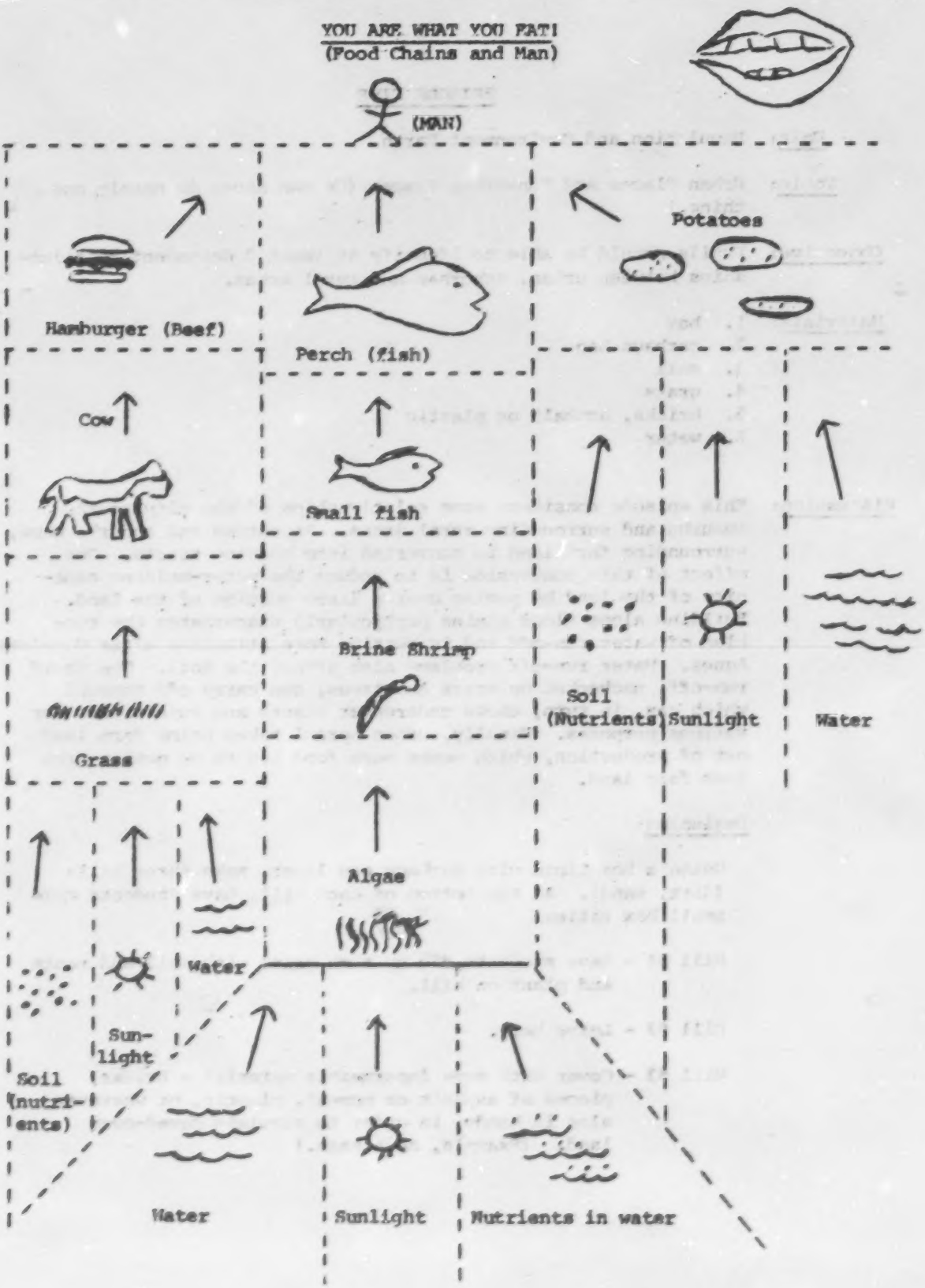
Food made inlleaves (green in leaves is Cholorophyll)

Stem carries water and Nutrients to leaves

Stem carries food back down to Roots

Water and Nutrients (Minerals) from Soil enter Roots

YOU ARE WHAT YOU EAT!
(Food Chains and Man)



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EPISODE FIVE

Unit: Population and Environment Earth

Topic: Urban Places and Non-Urban Places (We can never do merely one thing.)

Objective: Pupils should be able to identify at least 2 dependent relationships between urban, suburban and rural areas.

Materials:
1. box
2. garbage bag
3. soil
4. grass
5. bricks, asphalt or plastic
6. water

Discussion: This episode considers some relationships of the city to the suburbs and surrounding rural areas. As cities and suburbs grow, surrounding farm land is converted into housing tracts. One effect of this conversion is to reduce the water-holding capacity of the land by paving over a large portion of the land. Building along flood plains particularly exacerbates the problem of water run-off and is getting more attention after Hurricane Agnes. Water run-off problems also affect the soil. The rapid run-off, unchecked by grass and trees, can carry off topsoil which can, in turn, choke underwater plants and ruin rivers for various purposes. Finally, urban sprawl takes prime farm land out of production, which means more food has to be gotten from less farm land.

Beginning:

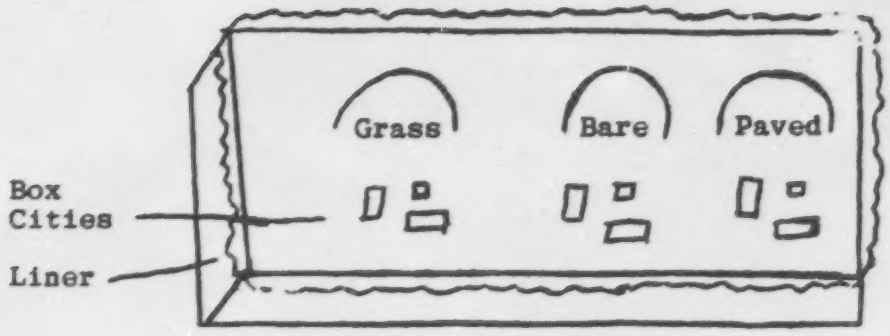
Using a box lined with garbage can liner, make three hills (dirt, sand). At the bottom of each hill, have students make small box cities.

Hill #1 - Have students dig up some grass with soil and roots and plant on hill.

Hill #2 - Leave bare.

Hill #3 - Cover with some impermeable material - bricks, pieces of asphalt or cement, plastic, or whatever else is handy, in order to simulate paved-over land. (Example, next page.)

Episode Five



Tell the class you (or they) are going to pour water slowly on the top of each hill.

Have the students predict results and give reasons.

Slowly pour water on top of each hill and observe effects.

Hill #1 - Grass should absorb water.

Hill #2 - Erosion should occur with some absorption; city may be washed out.

Hill #3 - Water should run off rapidly, washing out city.

Ask class how the hills in the experiment relate to population growth expansion of metropolitan areas. (Grass, farmland bulldozed; much of land paved over for roads, driveways; land covered by houses; all of which causes greater run-off.)

Give the class the following items and discuss in terms of the experiment: On a lot, 50 ft. by 120 ft., approximately 80% of the ground is covered by the houses and pavement (driveway, sidewalk, etc.) The car needs pavement. Discuss with the class paved-over land for car. (They may name roads, driveways, parking lots, gas stations.) How does this affect run-off?

Recall with the class, Hurricane Agnes. Ask the class to suggest possible connections between this episode and Agnes. Again, "We can never do merely one thing."

Episode Five

Continuing:

Hand out "Little Baltimore" sheets plus the first page of cut-outs (the one with parks on it). Discuss sheet with class as a sort of smaller model of Baltimore in the past. The buildings on the second page represent the stores, offices, houses, and apartments needed by the population in Little Baltimore. Have class cut out buildings and parks and place them in Little Baltimore in what they think is the best arrangement. (Farmland is off limits.) (see pp. 66, 67, & 68 for "Little Baltimore".)

Have them discuss with each other their placement of various types of buildings (their urban planning) and their reasons.

Now tell the class you are jumping ahead several years. Little Baltimore's population has doubled. Discuss needs (to build new houses, apartments, schools, etc.). Where will the city grow? (Farmland, need more sewers, roads, etc.) List these on chart as effects of population doubling.

Now give the class the second sheet. Tell them that they may draw in new roads through farms. Then have them place new buildings in the best way they see possible in order to achieve a livable city. (Parkland may have to be used to accommodate change in population.) After the class has finished, discuss process, effects of urban growth. You might relate use of farmland back to episode four (less good soil for food production) and the first part of this episode (paving over and its effects). Discuss in terms of gains and losses, choices that had to be made. You might use the term trade-off (i.e., city gains land for housing in exchange for loss of park and farm space).

Following Through:

Use pictures of Baltimore, past to present, and stylized growth of a city group.

Relate stages of Baltimore's growth to stages shown in growth of city group. Students might match these by taping on board.

Finally, closely analyze Baltimore's past to present pictures. Chart changes in natural environment, man-made physical environment, and cultural environment.

EPISODE SIX

Unit: Population and Environment Earth

Topic: Water, water everywhere? The quantity of water.

Objective: Pupils should be able to identify uses for water and reasons for demand for water.

Materials:
1. sheet on water uses
2. transparency - Measured Water Usage in the United States

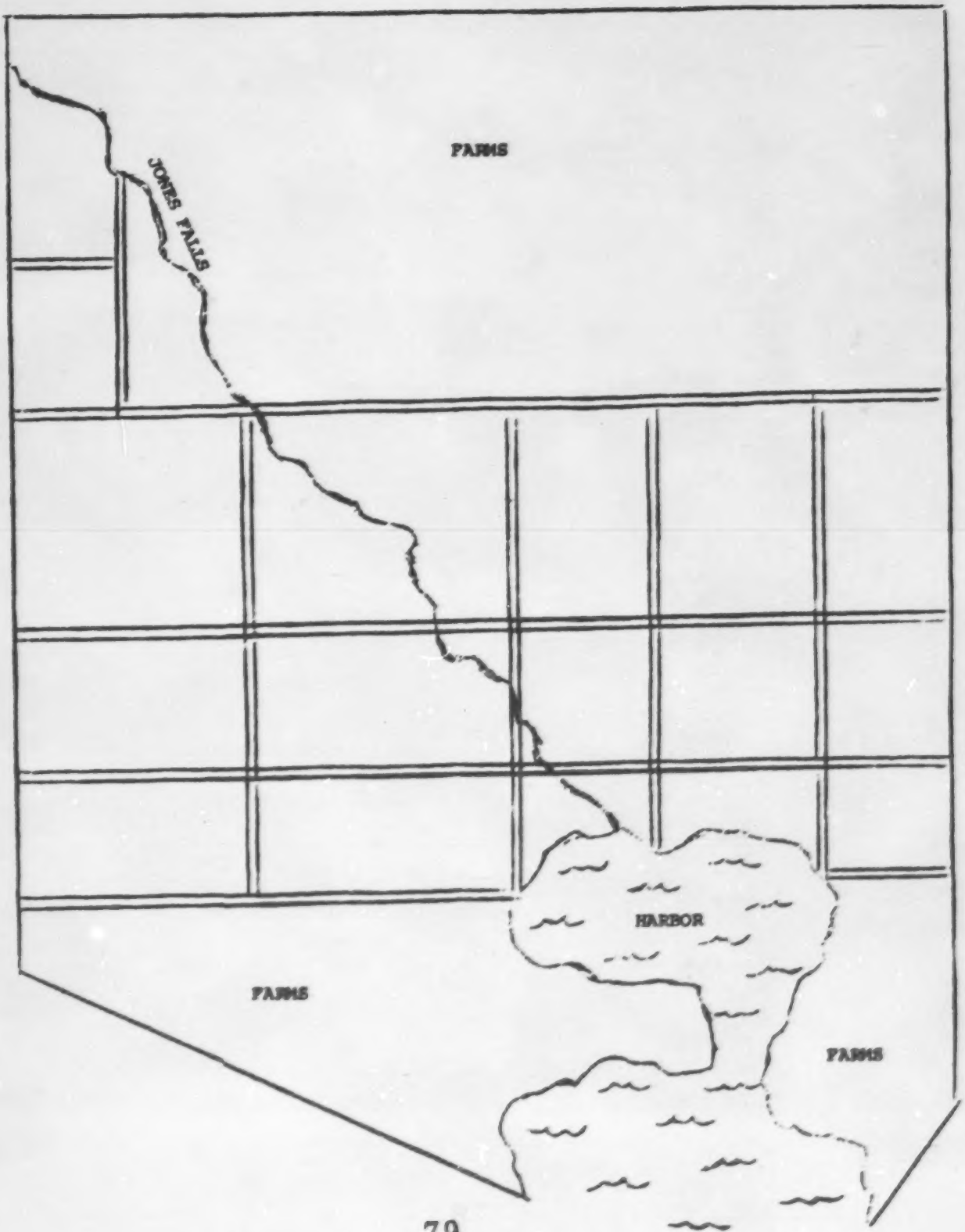
Discussion: This episode examines water usage and the ultimate limiting effect of the amount of water on population and/or our life-style. Other than direct personal uses of water, such as drinking and washing, there are many other direct and indirect uses of water, in farming, industry, and generating electricity. Even clothing involves the use of water whether it be watering sheep, processing wool, or manufacturing rayon. We can never do merely one thing.

The second part of the episode considers the growing demand for water in this country, a demand which has grown from about 550 gallons per person per day in 1900 to about 1750 gallons per person per day. Multiplied by a growing population, water usage in this country is expected to surpass the available supply of surface water by 1980. Large-scale use of ground water through drilling may have undesirable effects on the thin layer of soil we use for farming. Desalination of sea water is extremely expensive and is presently not practical on a large scale. Finally, melting the polar icecaps would put the coasts underwater. Suggestions have been made to tow icebergs down to Los Angeles. Speaking of the water problem, Dean Fraser states:

> ...The only difficulty is that we take water so much for granted that it is nearly impossible to believe that we really have water problems right now, even in the United States. The real predicaments, however, are still on the horizon and, as with many other aspects of the population problem, when they arrive, it may be too late to escape from them!!

Dean Fraser, The People Problem, Indiana University Press, Bloomington, 1972, p. 79.

LITTLE BALTIMORE



OFFICES
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HOSPITAL
HIGH SCHOOL
ELEMENTARY SCHOOL
HOUSES
APARTMENTS
HOUSES
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PARK
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OFFICES
STORES
HIGH SCHOOL
ELEMENTARY SCHOOL
HOSPITAL
HOUSES
HOUSES
HOUSES
HOUSES
HOUSES
HOUSES
HOUSES
HOUSES
APARTMENTS
APARTMENTS
HOUSES

Episode Six

Beginning:

List with class all possible uses of water that the class can think of. Discuss how water is used in each case. Your list might look something like this (after finishing the whole episode):

drinking	*sewage	*irrigation
washing	*air-conditioners	*electricity
clothes washer	*steel	transportation
cooking	watering grass	*clothing
tobacco	*washing car	housing - lumber
*swimming pools	*factories	
*toilets	*plastics	

Now give the class the sheet on water uses (Water, Water). Read with the class and discuss questions at the bottom. Add to the list of water uses.

Continuing:

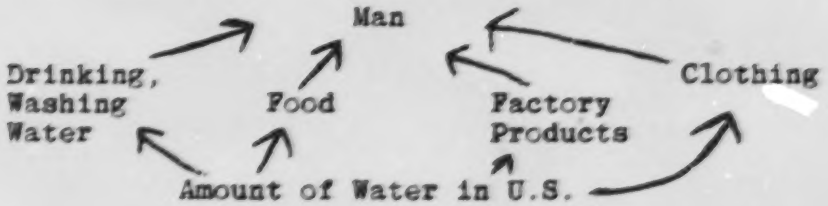
Show class the transparency of measured water usage in the United States.

Find the average amount used per day per person for each ten years. (Remind the class that this does not include unmeasured uses, such as farming, irrigation.)

Ask the class to analyze what has been happening to water usage per person.

The why: Go back to the list and put a star by those items which would not have been in use or much less in use in 1900. In short, people are technologically and economically better off; thus, more conveniences, products, and devices which use water, and more people.

Make the following chain with students:



Compare to food chain (man dependent on limited, finite amount of water).

Show second graph on transparency. After analyzing, discuss limiting effects of the amount of water on population and our life-style (consumption). You might wish to do this through the following question:

How might the available supply of water be made sufficient in the future? (By a stable population, by changing our lifestyle-consuming less, combination of both)

WATER, WATER

Below are listed some items and the amount of water used to produce each item. Do you see any new ways in which people use water?

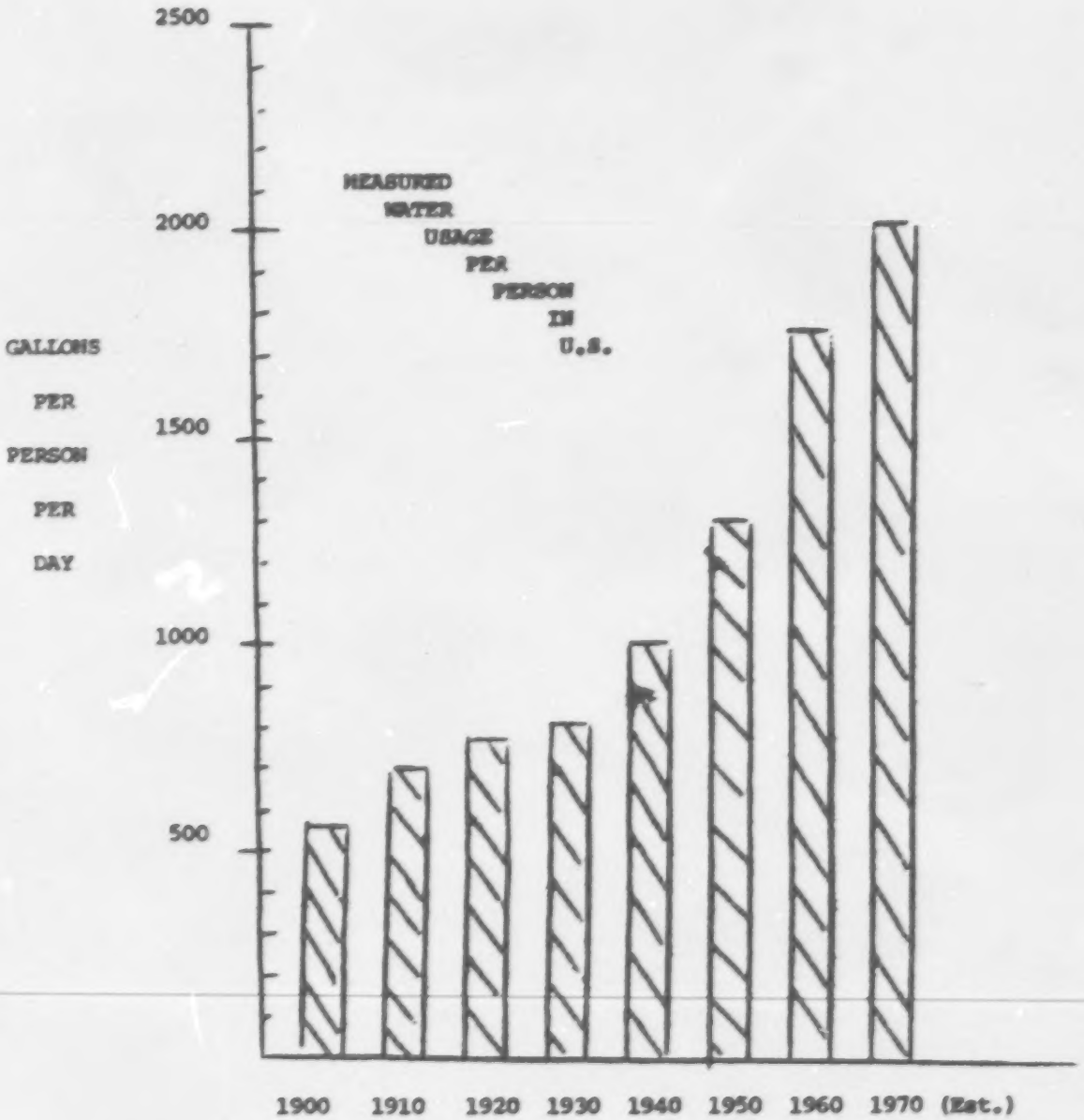
ITEM	AMOUNT OF WATER USED
One pound of wheat	120 gallons
One pound of beef	2300 gallons
Paper for one day for one person	200 gallons
Lumber for one day for one person	150 gallons
Wool for one day for one person	500 gallons
Tobacco for one day for one person	20 gallons
One pound of steel	32 gallons
One pound of rayon	168 gallons
One pound of rubber	566 gallons

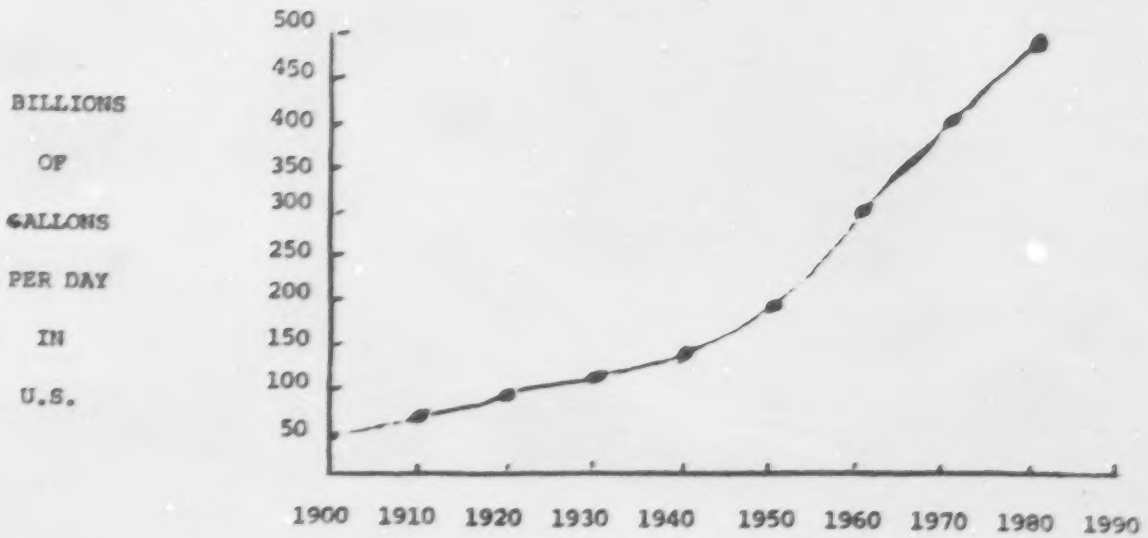
How is water used in producing each of these items?

Can you think of any other ways in which people use water, besides the ways listed above? Add them to your list.

*Above figures taken or extrapolated from Dean Fraser, The People Problem, Indiana University Press, Bloomington, 1972, Chapter 4.

WATER USAGE


2500
2000
1500
1000
500
GALLONS PER PERSON PER DAY
MEASURED WATER USAGE PER PERSON IN U.S.
1900
1910
1920
1930
1940
1950
1960
1970 (Est.)



Source of figures: Dean Fraser, The People Problem, Indiana University Press, 1972.

EPISODE SEVEN

Unit: Population and Environment Earth

Topic: What Goes In Must Come Out - Water Quality

Objective: Pupils should be able to identify at least 3 causes of water pollution.

Material: 1. story: "Travels with Walter" (pp. 79-88)

Discussion: The previous episode has considered water quantity. This episode switches over to the question of water quality. In the beginning, then, it will be useful to clarify the terms quantity and quality.

Water pollution problems are fairly well-known and need little elaboration. However, the New York City drought of 1965 rather uniquely shows the relationship between quantity and quality of water. After a four year drought, New York faced a serious water problem. Among other things, New York discovered it did not know where water went or how much was used. Restaurants had to stop serving drinking water. In a more humourous vein, Tiffany's was able to keep its fountain going in a suitably ostentatious manner by filling it with gin. Meanwhile, throughout the crisis, a huge amount of unusable water flowed right through New York City - the utterly polluted Hudson River.

Beginning:

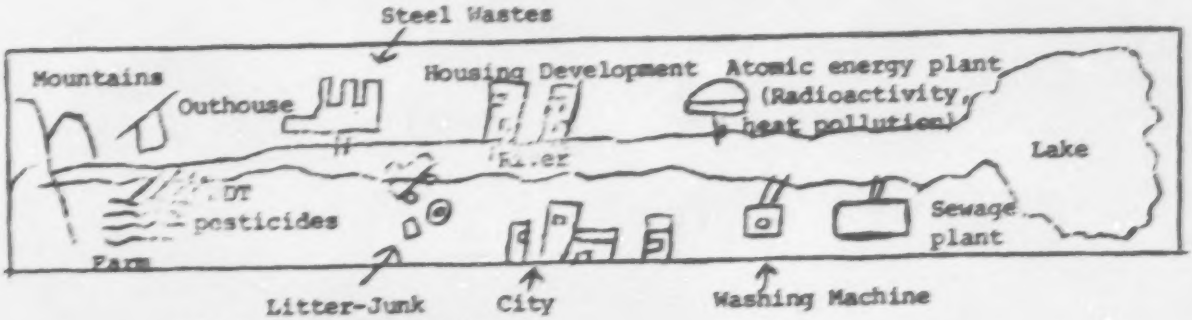
Give to the class copies of "Travels with Walter". After reading, have the class underline and then list sources of water pollution. Then circle and list effects of poor quality water.

Discuss use of water as dumping ground. You might focus on the concept "away". Can you throw something "away"? Can water carry something "away"? (There is really no "away". Things don't just disappear; they just go somewhere else.) In terms of water, things thrown "away" end up in the lakes or oceans which are finite bodies and, therefore, capable of containing only a limited amount of wastes before problems begin. Lake Erie is an excellent example of what can happen to a lake indiscriminately used as a dumping ground. Similar results are beginning to be noticed in other lakes. Finally, according to Thor Heyerdahl on his Ra voyage, wastes are already becoming obvious in the middle of the Atlantic Ocean.

Episode Seven

Continuing:

Based on "Travels with Walter", have the class divide into groups and make pictures of sources of water pollution to cut out and paste on a mural. Another group could make the mural ground - a river flowing into a lake. The lists made previously in the episode could then be attached to the mural as an explanation. The mural might look something like this:



Following Through:

Have a group write a letter to the Bureau of Water Supply.

Ask for consumption figures for Baltimore City, sources of water, how water is brought to us in a sanitary form.

EPISODE EIGHT

Unit: Population and Environment Earth

Topic: Man-made Environment

Objective: Pupils should be able to relate population issues to personal conflicts within their own community.

Material: 1. Film or story "Evan's Corner"

Discussion: This episode uses the film (or story) "Evan's Corner" to explore population and the man-made environment. It might be useful to begin the episode by stressing that this episode emphasizes the psychological environment rather than the physical, natural environment and by clarifying the meaning of psychological environment. The term conflict should be developed through this episode so as to include inner conflicts between different desires as well as outward conflict between different people. Finally, the episode looks at Evan's attempt to change his man-made physical environment in order to meet his psychological needs.

Beginning:

Show film "Evan's Corner" (or read the story to the class)

Discuss with the class Evan's desire to be alone, possible reasons. How does population pressure cause a conflict? Evan must decide between his desire to be alone and dealing humanely with others in his family, especially his little brother. An example of a trade-off.

Discuss being alone with the class. Do you ever want to be alone? When? Where do you go? Does a conflict ever arise between your desire to be alone and other people? How do you deal with it?

How does growing population in the city affect your desires to be alone? Your desire for quiet? Do examples: Family members bother you; people on street bother you; yells, cars going by, sirens. What conflict is set up? (Desire to be alone versus desire to treat people nicely because you also need people.) You might discuss ways people need people.

What are some ways people deal with this conflict? (Like Evan - by anger, by giving up quiet, by violence, etc.)

Episode Eight

Continuing:

Role-play: Have children role play the following situations, showing conflicts that might arise due to population:

1. going to the beach
2. going to the park
3. riding bicycle or skating
4. going to play basketball
5. going to school
6. going to a hospital
7. going to a ballgame
8. raising a family

You might have children look at the effects of growing population on the following categories in their role-play:

time involved
quality of activity
noise
competing consumers
money per person
etc.

Reminder: Factors other than population and population growth enter in - group values, distribution of people, use of streets for cars, etc. These should also enter into the conversation. Example: A stable population would not mean that parks would not be crowded, messy, or polluted sometimes; it just means that they wouldn't be as crowded. Obviously, attitudes toward consumption need changing in some areas.

Finally, it has been projected that per capita income would go up with a stable population. This should mean that more emphasis on quality instead of quantity could result. Example: With more money in taxes per capita, and fewer educational consumers in relationship to taxpayers, one could hope that class size could be cut, instead of hiring more teachers just to keep class size to about 35 per teacher.

EPISODE NINE

Unit: Population and Environment Earth

Topic: A Continuing Activity

Objective: Pupils should be able to construct a display, using data interpreted from graphs, arithmetic computation, and predicted growth.

Materials:
1. bottle tops
2. aquarium
3. flat box
4. toothpicks

Discussion: This activity involves the setting up of a model for investigating population growth in relationship to the carrying capacity of the environment. As an analogy to Earth, it is important to remember that the "environment" used for the model cannot be exchanged for a larger one. The only variables are birth and death rates as migration does not affect the world's population. This model allows the class to observe and graph a population explosion, to see how population growth multiplies itself by providing an ever larger population for the growth rate to act on. The model also gives students a chance to observe different growth rates and/or seek solutions to the problem of over-running the environment's carrying capacity. For those doing this activity as part of the Environment Earth section, it is suggested that they do follow-through activity number three, also. This activity might be one you wish to do as soon as the class enters each morning as a before nine o'clock activity.

NOTE: This episode is to be the last episode for both the Demography section and the Environment Earth section.

Activity:

The term environment is introduced and applied to the box or the aquarium. Bottle tops are introduced as symbols for people (or other living things). Aquarium is introduced as analogous to Earth, specifically the biosphere, and life beyond the aquarium is understood as impossible (no air, food, etc.).

Four bottle tops are introduced (i.e., 2 "families"). A growth rate is established (e.g., 3 "children" per "family", 1 "death" per "family" per day). Births mean new bottle tops are added; deaths mean bottle tops are removed. Each day may be thought of as a ten or twenty year period, if desired.

Episode Nine

Day #1 - 6 "births", 2 "deaths"
birth rate 15/1000 per day (i.e., 1500 births per 1000 population)
death rate 5/1000 per day (500 deaths per 1000)

growth rate 100% (1000 new people per 1000)
absolute growth 1st day - 4 population = 8 (number of new people)

Day #2 - Growth rate remains the same throughout.
growth = 8 population = 16

Day #3 - growth = 16 population = 32

Day #4 - growth = 32 population = 64

Day #5 - growth = 64 population = 128

etc.

Growth continues until population reaches carrying capacity and bottle tops begin falling out of the aquarium. (i.e., People die because biosphere can no longer support them - no air, food, etc. left for new people.)

Continue analogy with Earth and its carrying capacity.

Following Through:

1. Compute days required to reach carrying capacity and try the same experiment with lower and higher growth rates and compare lengths of time to reach carrying capacity.

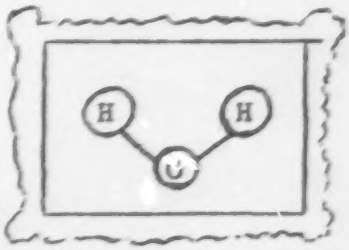
2. Try to find solutions (pupils may suggest equalling out birth and death rates); a larger container will not be allowed.

3. Try the same experiment using a flat box, and as the environment, food and buildings for housing. For example, each bottle top might need one toothpick to eat each day and a match box house for every four people (bottle tops). Capacity would be reached when there is no longer any room to "grow" toothpicks (this growth could be done by placing toothpicks side by side to represent a crop needing space to grow.) and match boxes start falling when placed on top of each other.

NOTE: Students would graph each day's growth on a large sheet, in order to visualize and see the geometric progression.

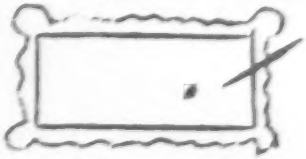
TRAVELS WITH WALTER

Hello. My name is Walter. I am a water molecule. You probably wonder how a water molecule could be talking to you. Well, I have gotten together several million of my friends - some other water molecules and some ink drops. I have been leading them around for several days. We leave some of the ink drops behind so that our trail spells out words. You might also be interested to know that I learned to write English by watching this very weird fellow who wrote horror stories. At the time, I was living in an aquarium which he kept on his desk. The weird fellow's name, I later found out, was Edgar Allan Poe. Here is a close-up picture of me: I'm not much to look at, am I?



The two H's are hydrogen atoms. The O is an oxygen atom. That's all there is to me, two hydrogen atoms and one oxygen atom. I may be small, but I'm important. I guess you probably know all about that.

One thing I like about being a water molecule is that I get to travel a lot. I've been in all the oceans and most of the lakes and rivers in the world. I've been inside many plants and animals and even people. You name it, I've been there. Why, I even went to the moon and back with some of the astronauts. I was in a bottle of Tang at the time. I also spent some time as part of the blood of one of the presidents. (I can't tell you which one. That's secret information.)

Another thing I like about being a water molecule is that I get to change forms. Sometimes I get together with a lot of other molecules, and we make a liquid which you call water. At other times, we separate and I float up into the air. This is the form you call water vapor. Here is my picture when I am in water vapor form: Aha! Fooled you. You can't see me when I'm floating around in the air in my water vapor form. That's because I'm so small. Sometimes, however, I can get together in the air with some other molecules. We all gather around a particle of dust, or sometimes around a particle of pollution. I much prefer a plain old particle of dust to a particle of pollution. Anyhow, when enough of us get together, we form a cloud. Now, here is my picture:  That's me in the corner. When the air cools off, we fall out of the air. You call this rain. If it's cold, we may come down as snow or sleet or hail. That's my other form, ice. I once spent fifty years as part of a piece of ice at the North Pole. It was cold, I'll tell you. I couldn't move around either. Just sitting in the same old place for fifty years. I thought we would never melt. Finally, we fell off into the ocean, and, within two weeks, we were liquid water again. It was awfully nice to be free. So, you see, whether I'm in my liquid water form, my water vapor form, or my ice form, it's still me. Good old Walter, the water molecule.

Well, what I wanted to tell you about was my last trip. Me and some of my friends (or should that be "Some of my friends and I"?) had formed a cloud along with some dust particles. We were floating along when we came to a mountain. We had to go up higher to get over the mountain. We never made it. It was cooler up high so the air couldn't

hold us any more. We fell on the mountain as rain. Falling from the sky is sure some fun. You know how your stomach feels on some of the rides at Gwynn Oak? Well, that's how I feel as I fall to earth (only I don't have a stomach). Luckily, the raindrop I was in hit some leaves on the way down so I didn't hit the ground too hard. Let me tell you, it really hurts when you hit smack dab on a sidewalk.

There were lots of grass and trees on this mountain so it was going to be a while before we got a stream. You see, grass and trees slow us down, keep us from quickly running off into a stream. In fact, most of us end up in the ground. I didn't get absorbed by the ground this time, though. I just sort of trickled along over the grass and dirt with some of my friends. (Trickling along over the grass tickles. I guess for you it would be like the feel of grass on your bare feet.)

As we trickled along down the mountain, we ran into a lot of other water molecules trickling along. We kept getting bigger and bigger as we met up with more and more water trickling down the mountain. Pretty soon we were a little stream of water. As we met up with a lot of other little streams, we got even bigger until we became a creek. We were moving faster now. There were millions and billions of other water molecules now. We became an even bigger creek. It was about then, just as I was getting really excited, that the trouble began.

I began to notice more and more bacteria scattered among my friends and me. Why were there so many? I looked more closely. Just behind me were three typhoid bacteria. Within fifteen minutes I had also noticed small groups of cholera bacteria, tuberculosis bacteria, salmonella bacteria, and tetanus bacteria. None what I call friendly bacteria. The typhoid bacteria even shoved me around as they went past. I was good and mad, but there were three of them and only one of me. I still didn't know why there were so many. Where had they all

come from? The answer was not long in coming. Just ahead of me were several coliform bacteria! Now I knew why there were so many bacteria because, you see, coliform bacteria come from sewage. Someone was dumping raw sewage right in among us water molecules. With all the things we do for people, you would think they would treat us better.

I didn't have much chance to think about this, however, because at that moment one of my friends yelled, "Look out!" I looked up just in time to see this huge body letting go of a rope and hurtling down on me. There was a mad pushing and shoving as the water molecules in the area tried to get out of the way of this huge monster. (To you this was an eleven year old boy; but, when you're as small as I am and looking up, it's a huge monster.) What you call a splash is just all us water molecules trying to get out of the way. Actually, it's good fun being part of a splash, getting knocked up into the air and then falling back down among all the other water molecules. When a really big, fat man hits the water, I can really have some fun.

I had almost forgotten all the bacteria in the excitement. (I wonder if that boy had forgotten the bacteria, too.) Up ahead I could see a huge pipe emptying into the water and that ugly, blue-gray stuff coming out could only be raw sewage. I tried to get over to the other side of the creek, but the rest of the water molecules had seen the pipe, too, and weren't about to switch places with me. I thought I heard a cheer from the bacteria when they saw the pipe. More food for them, I guess, and more bacteria. I was getting very depressed, so I decided to do something about it.

Now, bacteria can do something I can't. They can divide in two as long as they have something to feed on, and the temperature is right. (Bacteria are really tiny plants, you know.) So I decided to start up a conversation with these two typhoid bacteria. I was hoping that they

would get so interested in our conversation that they would forget to divide. No way. While we were talking, they both divided. Now I was talking to four bacteria instead of two. The conversation still went on, however, and pretty soon all four of them divided. There were eight bacteria now where there had been only two a few minutes ago. I was surrounded! There wouldn't be any more eleven year old boys and girls jumping on top of us water molecules now.

I noticed that there were several dead fish floating on top of the water. I wondered about this so I did a little checking around. (A good author, I think, should do a little checking around so he can have the information needed to know what is going on.) The problem, I found out, was that sewage and bacteria used up the oxygen in the water. So, since they didn't have enough oxygen to breathe, the fish died. Besides that, if I were a person, I don't think I would want to eat the fish that are in here now. They better put up a "No Fishing" sign next to that "No Swimming" sign. The stream isn't doing too well now; but, hang on, there's more to come.

It was about two days later, to the best of my recollection, that my creek came to a sudden end. There, stretching before us, was a mighty river. My creek added its billions and trillions of water molecules to the trillions and zillions of water molecules in the river. I was no longer part of a small creek. I was now part of a mighty river. Unfortunately, in addition to its water molecules, my creek had also added its sewage and bacteria to the river. But the river was big and didn't have many bacteria in it when my creek joined it. I still saw a lot of bacteria but not as many as before. Now don't get me wrong, the sewage and bacteria didn't just go away. It's just that there were a lot more water molecules now, so the sewage and bacteria got mixed around with a lot more water than they had before when they were in the creek. I began to notice more fish now - live fish. I guess they were

already in the river when my creek joined the river. A little later I got passed through the gills of a fish who had been in my creek. (His gills take out the oxygen that is mixed up with us water molecules.) He said he had just about given up finding enough oxygen in the creek. But then, he said, the creek joined the river, and there was a good deal more oxygen. He said he was feeling much better now. I hope I run into him again.

It was about then that bad trouble began again. We were flowing past some farms when I began to notice a lot of chemicals in the water. It rained the next day and, by the time the rain had run off into the river, the amount of chemicals in the water seemed huge to me. The chemicals were what people call "pesticides". They are used to kill insects that feed on crops. I had a talk with one of the pesticides, an old guy named DDT. He said people weren't using him much anymore. He said he was a dangerous fellow, that he had been responsible for the death of many fish and that, wehn we got into birds, they laid fewer eggs and sometimes couldn't even make a shell for the eggs they did lay. He also said that DDT has been found in human babies. "But", he also said, "I don't really mean to hurt living things. I'm just doing my job." And then he went on about his business, along with all the other pesticides. A few days later I noticed a lot of dead fish floating on top of the water. I hoped the fish that I ran into the other day wasn't one of them.

Oh, yeah, one thing I forgot to tell you. Some of my friends went on a side trip. It seems they were part of the water taken from the river to supply this town. You're probably wondering right now how a town could use water filled with bacteria to drink and wash. Well, according to my friends, some chemicals are put in the water before the people drink it. These chemicals, like chlorine, kill all the bacteria.

Well, the towns further down the river won't be able to use any of the river water now. The chemicals they put in may kill all the bacteria, but they can't kill the pesticides because the pesticides have never been alive. So, you see, they would have to get the pesticides totally out of the water if they were going to use it for drinking and washing.

A couple of days later the river passed its first city. Housing developments were being built all over the place. I noticed more soil in the water now. I also noticed more sewage. And then it rained. I was amazed to see how many phosphates there were in the water now. I was also a little happy because, you see, algae uses phosphates to grow. You probably already know algae is that green sea-weedy stuff in the water, and that tiny shellfish eat algae, and bigger fish eat the shellfish. Then even bigger fish eat those fish. One of the phosphates was a friendly fellow. He said he came from a box of detergent. He also said he had been in a TV commercial once. According to him, there was a time when detergents didn't have phosphates. But then, he said, people had very quickly gotten tired of having suds in their drinking water. So phosphate detergents were invented. Everybody knew phosphates were good for algae, and phosphate detergents didn't leave suds in the lakes which would later be used to supply cities with water. He said "goodbye" and took off to find some algae. We may have picked up more soil and sewage, but I was happy with this phosphate fellow, who was good for the algae. And what's good for algae must be good for fish.

As we went past the city we came to the factories. (I wonder why the factories were below the town and not above it?) Animal hair, animal fat and guts, acids, mercury, oils, and tars from the factories were all in the water now. I also noticed a small amount of radioactivity. I was puzzled. The fish and plants weren't puzzled, though. The higher temperature was too high for many of them. They couldn't live in the

warmer water. (Different kinds of fish and plants need different temperatures in order to live. The fish and plants in my river needed cold water to live in while the fish and plants in Florida, for example, need warmer temperatures.) I still didn't know what had caused the water to suddenly become warmer, and what had caused the radioactivity. I just floated off downstream, very puzzled. "There must be something which is causing this," I said to myself. "That's why I can't figure it out."

Well, I didn't have time to be puzzled long. Up ahead I could see the river emptying into a lake. I became very excited. There were zillions and zillions of water molecules in the lake. There would be so much water for the sewage and pesticides and bacteria and acids and mercury to get mixed up with. There would be more oxygen in the water. I looked forward to seeing all kinds of fish and plants. "Why, there may even be people swimming," I thought to myself. The trip down the river hadn't been any fun; but there couldn't possibly be enough sewage and crud in the water to mess up a lake this big. I was in for a surprise.

There was, in fact, a lot of water in the lake. But I didn't see many fish. What I did see was sewage and all that other stuff I told you about before. Oh, yeah, and one more thing. I saw more algae than I've ever seen before. Do you remember the phosphates I met up with before? The ones I told you were good for algae? Well, the problem is, they are too good. The algae was going wild. It was growing like mad. All the algae said they were king of the lake now. And they may have been right. You see, when algae rots, it uses up oxygen. Fish die then because they don't have enough oxygen. Rotting fish use up even more oxygen. So, between the rotting algae and fish, even more fish die. Meanwhile, the algae keeps right on growing, with phosphates and factory wastes supply-

ing the nutrients. The more algae grows, the more algae rots, and the more oxygen is used up.

There are only a few fish and eels left in the lake now, and none of them can be eaten by people. One more thing. I guess you know that there are only so many of us water molecules around, and this lake is so polluted that there is no way now that people can use all the zillions of water molecules in this lake. This lake is more like a sewer than a lake.

I've been working my way from the cold water down deep up to the warmer water on top. I have to get out of this sewer. I'm surrounded by sewage and bacteria and pesticides and factory wastes and dead fish and rotting algae. Now that I've gotten to the top of the water, I can only hope that I will be able to separate from the rest of the water and get up into the air. I keep saying to myself that I will soon be in my water vapor form and out of this lake.

Well, this is Walter signing off for now, stranded somewhere in Lake Erie.

Sincerely hoping to evaporate,

Walter

Oh, something I forgot. I kept a count of junk that had been dumped into the water. I have forgotten some of them, but here is a list of the things I remember:

1. 5 rusty automobiles
2. 2,346 cans
3. 1,181 bottles (many were broken)
4. 2 baby carriages
5. 12 old bicycles
6. 9 Barbie dolls

7. 31 ball point pens
8. 34 bottle openers
9. 49 Colonel Sanders chicken boxes
10. 185 Gino's cups
11. 1 bulldozer
12. 532 automobile tires
13. 2 kitchen sinks
14. 11 cans of Rapid Shave
15. 4 bed springs
16. 3 stoves
17. 5 refrigerators
18. 4 shopping carts
19. 192 pairs of shoes
20. 856 candy wrappers
21. 22 report cards

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Rosenthal, Ricky., The Splendor That Was Africa. New York: Oceana Publications, 1967.

Teachers' References (Con't)

Simpson, George E. and Yinger, J. Milton., Racial and Cultural Minorities - An Analysis of Prejudice and Discrimination. (Revised Edition). New York: Harper and Brothers, 1959.

Terry, Mark., Teaching for Survival. Friends of the Earth/Ballantine, 1971.

Wax, Murray C., Indian Americans Unity and Diversity. New Jersey: Prentice-Hall, Incorporated, 1971.

Wissler, Clark., Indians of the United States. (Revised Edition) New York: Doubleday and Company, 1966.

BOOKS FOR STUDENTS

Publisher	Author	Title
Associated Publishers, Incorporated	Woodson, Carter G.	African Heroes and Heroines
Columbia Books	Population Reference Bureau	People! The World Population Dilemma
Creative Education Press	Liberty, Gene, Ed.	Population
J.B. Lippincott Company	Stinetorf, Louis	Children of Africa
Crowell	Shawers, Paul	Look At Your Eyes
Medium Books for Children	Lerney, Marguarite	Red Man, White Man, African Chief
Walts	Huges, Langston	First Book of Africa
	Redding, Saunders	They Came in Chains; American from Africa

TRIPS

LOCATION	TELEPHONE NUMBER
1. Filtration Plants Montebello - Hillen Road	243-6019
2. Tour Baltimore City Original Boundary Lines Present Boundary Lines	
3. Census Bureau	
4. Department of Health and Mental Hygiene 301 West Preston Street	
A. Air Pollution Control 610 West Preston Street	383-2779
B. Birth, Death, Marriage - Divorce Records 301 West Preston Street	
C. Pollution Reporting Operation Lookout	383-4900
D. Water Pollution	383-2736
E. Water Supply	383-2767
5. Environment Protection Agency	
Pesticide Office 40 South Gay Street	962-3454
Water Quality Office	268-5038
6. Geological Survey Water Resource 8809 Satyr Hill Road	611-4664
7. Federal Water Pollution Control Administration Chesapeake Field Station Annapolis Science Center Annapolis, Maryland	268-5038

TRIPS (Con't)

8. Fish and Wildlife Service — 776-4880
   Patuxent Wildlife Research Center
   Laurel Bowie Road
   Laurel, Maryland

9. Conowingo Dam
   Peach Bottom Atomic Energy Plant
   Peach Bottom, Maryland

10. Land Usage - Farms, Suburbs,
    City Density

11. Liberty Dam
    Liberty Road

12. Anacostia Museum
    North Cholas Avenue and Talbert Street
    Washington, D.C.

13. Frederic Douglas House
    1411 W Street, S.E.
    Washington, D.C.

14. Museum of African Art
    316 A Street, N.E.
    Washington, D.C.

15. Colonial Environment Quarters
    Jamestown, Mt. Vernon, Williamsburg

16. Indian Center
    400 South Broadway

17. Center for Black Education
    14th and Fairmount Street, N.W.
    Washington, D.C.

18. Carroll County Farm Museum
    (Technology and Farming: Its Effect on
    Population Growth)

POPULATION EDUCATION

INDEX OF AUDIO-VISUAL MATERIALS AVAILABLE FROM

THE INSTRUCTIONAL MATERIALS CENTER

1. ACCELERATION OF THE SEVENTIES 7 MIN. COLOR JH-SH SD-1588.1

   EMPHASIZES POPULATION GROWTH AND TECHNOLOGICAL GROWTH AS THE TWO MAIN FACTORS INTERACTING TO BRING ABOUT DRAMATIC CHANGES IN OUR WORLD. PRESSURES ARE GROWING FOR NEW METHODS, NEW TOOLS, AND NEW PRODUCTS. (1970)

2. BOOMSVILLE 11 MIN. COLOR M-L-JH-SH SD-1530.1

   A BRILLIANT, ANIMATED OVERVIEW OF THE GROWTH OF CITIES. WITHOUT A WORD OF NARRATION, THE FILM TRACES THE STEP-BY-STEP PROCESS BY WHICH MAN TOOK A VIRGIN LAND AND MADE OF IT A FRANTIC, CONGESTED "BOOMSVILLE". (1970)

3. CHANGING CITY, THE 16 MIN. COLOR JH-SH-C SD-1066.2

   DESCRIBES THE ECONOMIC, SOCIAL AND CULTURAL ADVANTAGES OF THE CITY THAT HAVE CAUSED ITS ENORMOUS GROWTH. THE HISTORICAL PATTERN OF GROWTH IS SHOWN THROUGH THE NINETEENTH CENTURY TO THE 1960'S. (1963)

4. FOR YOUR PLEASURE 4 MIN. COLOR SD-555.1

5. RISE OF THE AMERICAN CITY 23 MIN. COLOR JH-SH SD-763.3

   THE SURGING GROWTH OF OUR GREAT CITIES HAS TRANSFORMED THE FACE OF THE NATION. THE CITIES NOW FACE A HOST OF PROBLEMS: POLLUTION, POVERTY, HUNGER, VIOLENCE AND SOCIAL CHANGE. (1972)

POPULATION BARGAINS

	Periodicals & Magazines Available
1) Population Crisis Committee 1730 K Street, N.W. Washington, D.C. 20006	Free Newsletter and Bulletin
2) Population Reference Bureau 1755 Massachusetts Avenue, N.W. Washington, D.C.	Student rate - $5/year For Population Bulletin, Population Reference Bureau Studies, Selected Reprints, Data Sheets
3) Population Council 245 Park Avenue New York, New York 10017	Free: 1. Students in Family Planning 2. Country Profiles 3. Reports on Population/ Family Planning 4. Current Publications
4) Victor Bostrum Fund 1730 K Street, N.W. Washington, D.C. 20006	Free quarterly reports on national fertility control programs
5) Population Association of America P.O. Box 14182 Benjamin Franklin Station Washington, D.C. 20044	Student membership - $6/year Includes subscription to Demography (6 issues/year) and Population Index (4 issues/year)
6) American Association for the Advancement of Science 1515 Massachusetts Avenue Washington, D.C. 20005	Student membership - $12/2 years Includes subscription to Science (weekly)
7) Planned Parenthood-World Population 666 Fifth Avenue New York, New York 10019	Free quarterly Family Planning Perspectives
8) Department of State Agency for International Development Office of Public Affairs Washington, D.C. 20523	Free monthly magazine "War on Hunger"
9) National Center for Family Planning Services Health Services and Mental Health Administration Department of Health, Education and Welfare 5600 Fishers Lane, Room 12A-33 Rockville, Maryland 20852	Free Newsletter "Family Planning Digest"